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Vol. 14, No. 2
January 31, 1989

Energy Research Abstracts

Abstracts 2741-4079

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UNITED STATES DEPARTMENT OF ENERGY

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ENERGY RESEARCH ABSTRACTS

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The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases, plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

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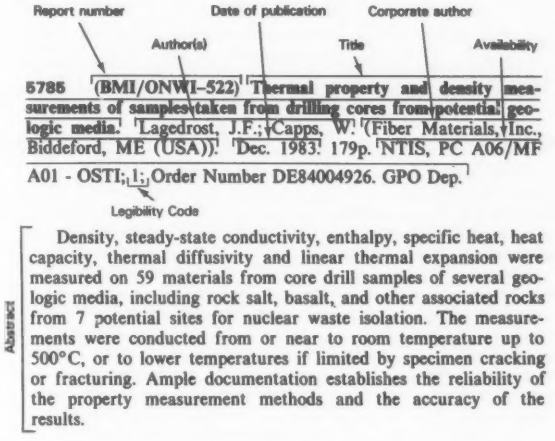
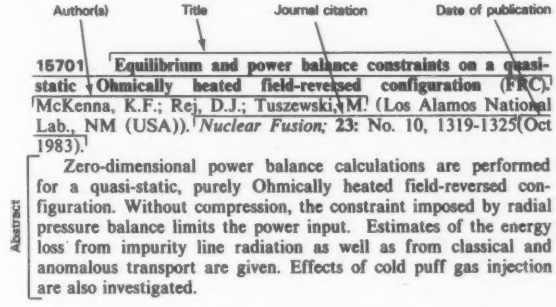
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01 - OSTI; 1; Order Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

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DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830 **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522 9:5785 NTIS, PC A09/MF A01. OSTI Order Number DE84004926, Distribution Category MN-70

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

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2741 **(DOE/MC/22068—2525) Component systems enhancement: Reduced girth seam weldments for heavy walled vessels: Final report.** (CBI Na-Con, Inc., Oak Brook, IL (USA)). Aug 1987. Contract AC21-86MC22068. 25p. NTIS, PC A03/MF A01. Order Number DE88001023/JAW.

Since many coal gasification processes require heavy-wall pressure vessels as an integral part of the process train, new concepts to reduce the cost and schedule for manufacturing and constructing heavy-wall pressure vessels will result in overall plant cost savings. The results of this research demonstrate that it is feasible to use a reduced girth seam weldment design equal to two-thirds of the nominal vessel wall thickness. This reduction in welding thickness greatly reduces the overall cost of heavy-wall vessels. This report summarizes results of nonlinear finite element analysis and scale model testing of various reduced girth seam details demonstrating that the local reduced thickness does not significantly reduce the ultimate pressure capacity of a heavy-wall vessel. The report also summarizes estimated cost and schedule savings for a typical coal gasification vessel that uses a reduced girth seam detail. In addition, estimated overall plant construction cost savings and overall plant operating and maintenance cost savings are presented. 11 refs., 1 fig., 6 tabs.

2742 **(DOE/PC/70787—T11) Novel liquefaction solvent H_2O--H_2S: Final report, April 1, 1988.** Stenberg, V.I. (USDOE Pittsburgh Energy Technology Center, PA). 1 Apr 1988. Contract FG22-84PC70787. 22p. NTIS, PC A03/MF A01. Order Number DE89002150/JAW.

In keeping with our objective of investigating the fundamental chemistry of coal liquefaction from the chemist's perspective, this project sought the answer to the question "Can coal be liquefied in a water medium with at least comparable yields to those obtained using traditional organic medium?" We have found that the novel H_2O-H_2S inorganic slurrying liquid gives superior liquefaction distillate product yields than do comparable isothermal reactions done with an industrial-type organic slurring liquid. Further enhancement of liquefaction yields can be obtained if temperature programming is used to match radical production with the ability of the medium to donate hydrogens. Temperature programming can be adapted to flow reactors by varying the temperature along the reactor tube. 5 refs., 18 tabs.

2743 **(DOE/PC/79908—T3) The hindered diffusion of coal liquids under non-reactive and high temperature and pressure reactive conditions: Quarterly report 3, March 15, 1988--June 14, 1988.** Tsotsis, T.T.; Sahimi, M.; Webster, I.A. (University of Southern California, Los Angeles (USA). Dept. of Chemical Engineering). 1988. Contract FG22-87PC79908. 19p. NTIS, PC A03/MF A01. Order Number DE89002269/JAW.

One of the obstacles in the design and optimization of catalytic coal liquefaction and petroleum and coal-liquid hydroprocessing reactors, is the lack of available experimental transport, thermodynamic and reaction data at realistic process conditions. The current fundamental understanding, furthermore, of transport and reaction processes at realistic process conditions is incomplete. It is the goal of this project to address these important problems. We have undertaken a theoretical and experimental study of "hindered diffusion" of model and real petroleum and coal liquids in model and real coal liquefaction and hydroprocessing catalysts under reactive and non-reactive conditions. 54 refs.

2744 **(DOE/PC/79923—T3) The effect of chemical additives on the synthesis of ethanol: Technical progress report 3, March 16, 1987--June 15, 1988.** Chuang, S.S.C. (Akron Univ., OH (USA). Dept. of Chemical Engineering). 22 Jul 1988. Contract FG22-87PC79923. 13p. NTIS, PC A03/MF A01. Order Number DE89002265/JAW.

The objective of this research is to elucidate the role of various chemical additives on ethanol synthesis over Rh- and Ni-based catalysts. Chemical additives used for this study will include S, P, Ag, Cu, Mn, and Na which have different electronegativities. The effect of additives on the surface state of the catalysts, heat of adsorption of reactant molecules, reaction intermediates, reaction pathways, reaction kinetics, and product distributions is/will be investigated by a series of experimental studies including temperature programmed desorption, infrared study of NO adsorption, reactive probing, steady state rate measurement, and transient kinetic study. During this quarter the effect of sulfur on CO insertion over RH/SiO_2 was studied in a wide range of reaction conditions to develop a better understanding of the role of sulfur in the oxygenate synthesis. 20 refs., 2 figs., 3 tabs.

2745 **(DOE/PC/79928—T3) Solid superacids as coal liquefaction catalysts: Quarterly report, April 1988-June 1988.** Tierney, J.W.; Wender, I. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1988. Contract FG22-87PC79928. 6p. NTIS, PC A02/MF A01. Order Number DE89002266/JAW.

Coal liquefaction is normally achieved by using high temperatures to crack covalent bonds which form linkages in the macromolecular coal structure. Acidic catalysts can crack covalent bonds at lower temperatures. This research is centered on the use of solid superacid catalysis in coal liquefaction. During this quarter, several superacids were synthesized and characterized. The catalysts were TiO_2, and Fe_2O_3, each containing SO_4/sup 2{minus}/ ions. These oxides possessed high acidity. The amount of acidity was measured by titrating with n-butylamine and indicators of varying pk/sub a/ values. The catalysts were characterized by surface area (BET) and x-ray diffraction (XRD). 4 refs.

2746 **(DOE/PC/79929—2) NO/sub x/-char reactions: Kinetics and transport aspects: Quarterly technical progress report, 1 April 1988-30 June 1988.** Calo, J.M.; Suuberg, E.M.; Teng, H.; Lilly, W.D. (Brown Univ., Providence, RI (USA). Div. of Engineering). 1988. Contract FG22-87PC79929. 21p. NTIS, PC A03/MF A01. Order Number DE89002276/JAW.

In this report, the focus is on preliminary characterization work performed on the phenol-formaldehyde resin chars selected as model compounds for this study. This work involves (1) ensuring that the new experimental system provides reproducible results; and (2) comparing the reaction behavior of the chars in O_2 with that in NO. The following measurements have been completed: (1) chemisorption of O_2 on 1000{degree}C char, in order to determine its active surface area; (2) measurement of the surface area of the above char, as a function of burnout in O_2 and NO; and (3) determination of the activation energies for O_2 and NO gasification. The following tasks are planned for the next report period: (1) determination of the reaction order of the NO-char gasification reaction, as

a function of temperature; (2) determination of the reaction order for chemisorption of NO on the char surface; and (3) determination of the products of gasification at low and high temperature gasification conditions. 13 refs., 7 figs., 3 tabs.

2747 **(DOE/PC/79936—2) Low severity conversion of activated coal: Quarterly report No. 2 for the period December 1, 1987 through February 29, 1988.** Hirschon, A.S.; Ross, D.S. (SRI International, Menlo Park, CA (USA)). Mar 1988. Contract AC22-87PC79936. 29p. NTIS, PC A03/MF A01. Order Number DE88017219/JAW.

The objectives of this project are to: (1) develop an understanding of hydrothermal pretreatment chemistry and its optimization at temperatures and pressures no greater than 250{degree}C and 1000 psi; (2) develop a series of highly reactive and dispersible promoters of bond hydrogenolysis operating at temperatures no greater than 300{degree}C; and (3) successfully combine the pretreatment and hydrotreating steps to obtain high yields of toluene soluble coal products. The program is divided into four tasks, the first of which, Task 1, is a project work plan that we have already submitted. Our experimental work during this quarter for Tasks 2 and 3 is summarized.

2748 **(ORNL—6486) Fossil energy program semiannual progress report for October 1987 through March 1988.** (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 139p. NTIS, PC A07/MF A01. Order Number DE89001137/JAW.

This report covers progress made during the period October 1, 1987, through March 31, 1988, for research and development projects that contribute to the advancement of various fossil energy technologies. Projects on the Fossil Energy Program are supported by DOE Office of Fossil Energy, DOE Office of Basic Energy Sciences, and the Tennessee Valley Authority. The Fossil Energy Program organization chart is shown in the appendix. 77 refs., 36 figs., 18 tabs.

2749 **(PB—88-240551/XAB) Coal-particle pyrolysis mechanisms and temperatures. Report of Investigations/1988.** Hertzberg, M.; Zlochower, I.A.; Edwards, J.C. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1988. 46p. (BM-RI—9169). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600350.

Diverse observations of the rates and mechanisms for the pyrolysis and devolatilization of coal and polymethylmethacrylate (PMMA) are analyzed. New data are presented for PMMA, together with new morphological evidence for the microscopic structure of the pyrolysis and devolatilization wave front in coals. There is no substantive evidence to support the traditional viewpoint that the pyrolysis and devolatilization rate process occurs isothermally, under chemical rate control; or is described realistically by a classical, unimolecular Arrhenius function of temperature. Instead, the reaction process occurs as a highly nonisothermal, heat-flux-driven, pyrolysis and devolatilization wave front, whose speed of propagation is predictable by internal heat transport constraints. Except for the complication of its char-layer residue, whose increasing thickness insulates the pyrolysis wave front from the heat source flux that drives it, both coal and PMMA behave similarly during pyrolysis and devolatization.

2750 **(PB—88-240577/XAB) Effect of fluoride inclusions on induction-slag-melted Ti-6Al-4V alloy. Report of Investigations/1988.** Paige, J.I. (Bureau of Mines, Albany, OR (USA). Albany Research Center). 1988. 18p. (BM-RI—9164). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600414.

The effect of fluoride inclusions on the properties of titanium produced from the induction-slag-melting process is of concern to members of the titanium industry. The objective of the research was to determine the effect of CaF_2 inclusions on the properties of titanium and its survival rate during melting. The data were obtained from single-induction-slag-melted ingots prepared with the normal addition of 4 pct and also with 2- and 1-pct additions of CaF_2 slag. The results of this effort showed that the mechanical properties of single-induction-slag-melted Ti-6Al-4V alloy exceed the minimum values specified in Aerospace Materials Specification for Titanium Alloy Bars and Forgings AMS4928H, but these materials are much more notch-sensitive in fatigue than normal Ti-6Al-4V alloy titanium. First and second vacuum-arc remelts of single-induction-slag-melted ingots fragmented and increased the number of inclusions, while reductions in the amount of flux resulted in an upward trend in the spatial distance between pores in an x-y plane.

2751 **(PNL-SA—15627) Separation of gas mixtures by transition-metal complexes.** Lilga, M.A.; Hallen, R.T.; Nelson, D.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 6p. (CONF-880604—13). NTIS, PC A02/MF A01. Order Number DE89001473/JAW.

From Joint meeting of the 195th national meeting of the American Chemical Society and the 3rd Chemical Congress of North America; Toronto, Canada (5 Jun 1988).

The Pacific Northwest Laboratory (PNL) is examining transition-metal complexes as selective agents for the separation of syngas components from gas mixtures. Transition-metal complexes are known which react reversibly with gases such as H_2, CO, O_2, and CO_2. This reversible binding can be used to transfer the gas from a region of high partial pressure to a region of lower partial pressure. The selectivity of transfer is determined primarily by the selectivity of the metal in binding a specific gas. The nature of the ligands surrounding the metal has a large influence on the selectivity and reversibility and we have successfully used ligand modification to prepare complexes that have improved properties for H_2 or CO binding. Applications of metal complexes to gas separation and two specific examples of metal complexes under study will be discussed. 5 refs., 2 figs.

2752 **Coal liquefaction using an intermetallic hydride to distribute hydrogen and catalyze the reaction.** Johnson, S.D.; Smith, J.E. Jr. (Alabama Univ., Huntsville (USA)). *Applied Catalysis;* **44**: No. 1-2, 53-71(15 Nov 1988).

Iron-titanium alloy forms a reversible metal hydride which stores hydrogen as atomic hydrogen within its metal matrix at a density exceeding liquid hydrogen. The alloy has also been shown to have substantial catalytic properties towards hydrogenation reactions. The alloy has been examined as a vehicle to both transport and distribute hydrogen to slurried coal and catalyze the liquefaction process. Batch liquefaction experiments produced conversions of approximately 50% for industrially handled Utah (SUFCO) and Alabama Blue Creek coals slurried in either tetralin or 1-methylnaphthalene in less than 30 min at a temperature of 260 C and a pressure of 4.14 MPa. Comparison of the liquefaction results in tetralin and 1-methylnaphthalene suggested that tetralin was involved as a shuttling agent rather than a donor solvent for this approach. This catalytic process reduced the nitrogen, sulfur, and oxygen contents of the Utah coal by 25%, 50%, and 89.5% respectively, while the sulfur content of the Alabama coal was reduced by 34%. Both a simple first order mechanism and a more complex second order mechanism closely modeled the liquefaction data. Calculation, based on a run using non-hydrided FeTi, produced a catalytic turnover number of 3.10/sup -2/ molecules of hydrogen per site per s. This approach overcomes problems encountered in other liquefaction processes, while converting coal to liquid products at reduced operating conditions. A hydrogen adsorption study of the spent alloy showed a 4% deactivation of the catalyst. 5 figs., 50 refs., 3 tabs.

2753 **Fluidized-bed bioreactor system for the microbial solubilization of coal.** Scott, C.D.; Strandberg, G.W. US Patent Application 6-095,696. 14 Sep 1987. 19p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A fluidized-bed bioreactor system for the conversion of coal into microbially solubilized coal products. The fluidized-bed bioreactor continuously or periodically receives coal and bio-reactants and provides for the production of microbially solubilized coal products in an economical and efficient manner. An oxidation pretreatment process for rendering coal uniformly and more readily susceptible to microbial solubilization may be employed with the fluidized-bed bioreactor. 2 figs.

2754 **Fixed-bed bioreactor system for the microbial solubilization of coal.** Scott, C.D.; Strandberg, G.W. US Patent Application 6-095,708. 14 Sep 1987. 14p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A fixed-bed bioreactor system for the conversion of coal into microbially solubilized coal products. The fixed-bed bioreactor continuously or periodically receives coal and bio-reactants and provides for the large scale production of microbially solubilized coal products in an economical and efficient manner. An oxidation pretreatment process for rendering coal uniformly and more readily susceptible to microbial solubilization may be employed with the fixed-bed bioreactor. 1 fig., 1 tab.

0105 By-products

REFER ALSO TO CITATION(S) 2803, 3535

0106 Properties

REFER ALSO TO CITATION(S) 2742, 2743, 2748, 2773, 2777, 3918

2755 **(CONF-8809161—4) Determination of phenolic structures in low rank coals: Elucidation of transformation processes of lignin at the early stage of coalification.** Hayatsu, R.; McBeth, R.L.; Scott, R.G.; Winans, R.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE89000581/JAW.

From Symposium on Argonne premium coal samples; Los Angeles, CA, USA (25 Sep 1988).

The present study continues our investigation of transformation processes of plant organic material to coal during early stages of coalification. To understand alteration of phenolic structures in lignin, and natural and synthetic coals have been characterized by using two-step depolymerization procedure of alkaline hydrolysis followed by silver oxide oxidation. In parallel experiments, lignin model compounds and a polymer have been transformed using thermal catalytic reaction conditions that mimic natural catagenetic metamorphism. 14 refs., 1 fig., 2 tabs.

2756 **(DOE/PC/79914—T2) Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, March 16, 1988--June 15, 1988.** Peppas, N.A. (Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering). 1988. Contract FG22-87PC79914. 30p. NTIS, PC A03/MF A01. Order Number DE89002277/JAW.

During this funding period we completed the design and building of the new interferometer/polariscope for the determination of penetrant concentration and stress profiles in coal samples. We have started the studies of measurements of stresses in the coal samples, and we have started preparing various thin coal sections which are being tested for coal transport. Also, the sorption of pyridine vapor is discussed. 20 refs., 8 figs., 1 tab.

2757 **(DOE/PC/80262—T1) Additive development for ultra-clean coal slurry fuel: Final report.** Berggren, M.H.; Swanson, W.W. (AMAX Research and Development Center, Golden, CO (USA)). 24 May 1988. Contract AC22-85PC80262. 84p. NTIS, PC A05/MF A01. Order Number DE88011639/JAW.

AMAX performed research to develop improved quality, cost-effective dispersing additives for coal-water slurry fuels intended for high-intensity combustion systems. Dispersants were identified on the basis of coal surface characteristics and coal-dispersant interactions. Micronized samples of physically and chemically cleaned coal feedstocks from the Eastern and Midwestern regions of the United States were examined using bulk and surface analysis techniques. Utilization of coal surface and dispersant functionality was optimized through multicomponent application of additives, pH control, and control of surface oxidation. A low-cost, low-alkali, sulfur-free dextrin compound was found to be effective in enhancing dispersion when applied to the coal surfaces as a pretreatment or with conventional dispersants as a co-additive. The cleaning method and ash content had minimal direct impact on coal surface functionality. Parameters such as internal moisture, particle size, surface area, surface oxidation, and soluble ions were the primary considerations which influenced slurry loading and additive consumption. The dispersing additive packages functioned over the range of coal types and cleaning levels investigated. The preferred additives were compatible with each other, allowing for blending to optimize performance, cost, and alkali contamination. Each additive was found to be suitable for use in applications which utilize elevated-temperature fuel delivery systems. 17 refs., 8 figs., 27 tabs.

2758 **(PNL-SA—15868) Characterization of biodegraded coals.** Bean, R.M.; Franz, J.A.; Campbell, J.C.; Linehan, J.C.; Stewart, D.L.; Thomas, B.L. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1988. Contract AC06-76RL01830. 9p. (CONF-8809170—1). NTIS, PC A02/MF A01. Order Number DE89001732/JAW.

From Symposium on coal biodegradation; Los Angeles, CA, USA (25 Sep 1988).

We have been able to accomplish the biodegradation of bituminous Illinois No. 6 coal after a pretreatment consisting of air oxidation, using a culture of the fungus Penicillium sp. We report in this paper results of chemical and spectrometric analyses of the starting materials and products from Illinois No. 6 coal biodegradation, and compare the results with those previously reported from the biodegradation of leonardite. 13 refs., 1 fig., 5 tabs.

2759 **The nature and origins of coal macerals.** Given, P.H.; Dyrkacz, G.R. (Pennsylvania State Univ., University Park (USA)). pp 53-72 of New trends in coal science. Yueruem, Y. (ed.). Dordrecht, Netherlands; Kluwer Academic Publishers (1988). (CONF-8708183—).

From NATO advanced study institute conference on new trends in coal science; Datca, Turkey (24 Aug 1987).

The definition and nature of coal macerals is presented in terms of some current research. Recent work on the nature of several precursors of the liptinite maceral groups are discussed and compared to the corresponding liptinite macerals. The importance of separating macerals is considered, and some recent results using the density gradient centrifugation method of maceral separation is briefly reviewed. It is demonstrated that vitrinites are complex mixtures, not simple macerals. 2 figs., 49 refs., 1 tab.

2760 **Solid state /sup 13/C NMR in coal research. Selected techniques and application.** Miknis, F.P. (Western Research Institute, Laramie, WY (USA)). pp 117-158 of New trends in coal science. Yueruem, Y. (ed.). Dordrecht, Netherlands; Kluwer Academic Publishers (1988). (CONF-8708183—).

From NATO advanced study institute conference on new trends in coal science; Datca, Turkey (24 Aug 1987).

Developments in solid-state /sup 13/C NMR techniques and their applications in coal research are reviewed. These techniques include cross polarization and magic-angle spinning with high-power decoupling, dipolar dephasing, sideband suppression at high magnetic fields, dynamic nuclear polarization and combined rotation and multiple pulse spectroscopy. The quantitative reliability of /sup 13/C NMR aromaticity measurements is also discussed. Results from recent studies indicate that not all the carbons in coal are observed in the solid-state /sup 13/C NMR measurements. Thus, the question of the quantitative reliability of /sup 13/C NMR in coal research remains unresolved. Selected applications of solid-state /sup 13/C NMR for the study of pyrolysis and hydroliquefaction of coals are presented. Results of these studies indicate that solid-state /sup 13/C NMR can provide valuable information about aromaticity changes that occur during coal processing. 18 figs., 82 refs., 8 tabs.

2761 **A new approach for quantitative /sup 13/C NMR spectroscopy of coal.** Stock, L.M.; Muntean, J.V.; Botto, R.E. (Chicago Univ., IL (USA)). pp 159-167 of New trends in coal science. Yueruem, Y. (ed.). Dordrecht, Netherlands; Kluwer Academic Publishers (1988). (CONF-8708183—).

From NATO advanced study institute conference on new trends in coal science; Datca, Turkey (24 Aug 1987).

The use of tetrakis(trimethylsilyl)silane as a qualitative chemical shift standard and as a quantitative internal standard for

carbon-13 NMR spectroscopy of coals and the use of samarium(II) iodide as a reagent for the realization of more quantitative spectroscopic results through the selective removal of organic free radicals from coal are discussed. 2 figs., 15 refs., 1 tab.

0108 Waste Management

REFER ALSO TO CITATION(S) 2785, 3071

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 2769, 2771

2762 **(DOE/PC/79796—T4) Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 4, March 1, 1988--May 31, 1988.** (Energy and Environmental Research Corp., Irvine, CA (USA)). 20 Jun 1988. Contract FC22-87PC79796. 58p. NTIS, PC A04/MF A01. Order Number DE89002160/JAW.

The objective of this project is to demonstrate gas reburning-sorbent injection (GR-SI) emission control technology on three pre-NSPS coal-fired utility boilers in Illinois. The project goals are to achieve NO/sub x/ and SO/sub x/ emission reductions of 60 percent and 50 percent, respectively. Work progressed on all tasks. Baseline testing was completed on the wall fired boiler, and baseline testing has been scheduled on the tangentially fired boiler. Isothermal flow modeling work was completed for the wall fired and tangentially fired boilers and has been started for the cyclone fired boiler. The flow modeling results were used to aid in the design of reburn fuel, burnout air and sorbent injection systems. Further process specification work included thermal performance analysis to select arrangements for GR-SI installations. Also, a study of ESP performance at the three host sites and site specific ESP enhancement options has been initiated. Work in Task 3, Project Engineering, has also been initiated. In the environmental area, target dates have been set for the submittal of detailed, revised Environmental Information volumes for each site. Also, as part of Technology Transfer, an economic analysis of GR-SI was initiated. 9 figs.

2763 **(PB—88-236740/XAB) Draft environmental impact statement: Peabody Big Sky Mine - Area B, Rosebud County, Montana.** (Montana Dept. of State Lands, Helena (USA)). Jul 1988. 200p. NTIS, PC A09/MF A01.

Also pub. as Office of Surface Mining Reclamation and Enforcement (DI), Washington, DC. rept. no. OSM/EIS-26.

The Environmental Impact Statement (EIS) identifies and analyzes the probable impacts to the quality of the human environment that would result should the Secretary of the U.S. Department of the Interior (Secretary), the Federal Programs Division Chief (Division Chief), and the Commissioner of the Montana Department of State Lands (Commissioner) approve the mining proposal for, and the Peabody Coal Company (Peabody) subsequently develops, the proposed Big Sky Area B Mine. The EIS also identifies and analyzes probable cumulative impacts that would result from surface-coal-mining operations at permitted and proposed coal mines in the region.

2764 **(PB—88-237649/XAB) Pathophysiology of coal pneumoconiosis in Equidae. Final report No. 2, 1 June 1971-31 December 1973.** Davis, G.W.; Farrell, R.L.; Hamlin, R.L.; Smith, C.R.; Ghosh, S. (Ohio State Univ. Research Foundation, Columbus (USA)). Jun 1974. 51p. NTIS, PC A04/MF A01.

A group of 12 coal-mine ponies was studied to characterize the physiological parameters and pathological changes in spontaneous pneumoconiosis in Equidae. The six coal mines where the ponies worked were located in eastern West Virginia and western Pennsylvania. Gross lesions were seen at necropsy, similar to mild simple coal workers pneumoconiosis. None of the animals demonstrated disease comparable with the more-complicated human disease. Numerous punctate 1 millimeter to 1 centimeter coal macules were found in the lungs. The macules occurred primarily in subpleural and dependent portions of the lung, microscopically consisting of peribronchiolar aggregates of dust-laden pulmonary macrophages. Bronchiolar mucosal hyperplasia and peribronchiolar and perivascular fibrosis were also noted along with secondary emphysema and muscular hypertrophy. Ultrastructurally retained dust particles characterized the pulmonary lesions. A proliferation of alveolar type-II cells was noted. Those ponies with longer exposure periods demonstrated more severe pulmonary lesions.

2765 **(PB—88-239868/XAB) Effects of coal-mine drainage on the water quality of small receiving streams in Washington, 1975-77. Water-resources investigations.** Packard, F.A.; Skinner, E.L.; Fuste, L.A. (Geological Survey, Tacoma, WA (USA). Water Resources Div.). 1988. 74p. (USGS/WRD/WRI—85-4274). NTIS, PC A04/MF A01.

Drainage from abandoned coal mines in western and central Washington has minimal environmental impact. Water-quality data from 51 abandoned coal mines representing 11 major coal-bearing areas indicate that less than 1% of the mine drainage has a pH of 4.5 or less; less than 2% is acidified to a pH 5.6, a point where water and free atmospheric carbon dioxide are in equilibrium. A hydraulic mining test arranged near Wilkeson Creek indicated that large increases in suspended sediment and turbidity, accompanied by slight increases in temperature, are associated with hydraulic mining. Iron deposited along the stream channel. Hardness, alkalinity, sulfate, and dissolved solids increased; dissolved oxygen and pH decreased slightly. No difference in diversity of benthic organisms was found when all months of data were compared. Significant differences in diversity were found during low stream-flow months in a zone from the point where the mine drainage enters to about 50 feet downstream; correlations with water-quality measurements show that faunal changes are closely associated with iron and sulfate.

0120 Mining

REFER ALSO TO CITATION(S) 2780

2766 **(DOE/PC/79927—T2) New strategies for in-situ characterization of coal: Quarterly report, April 1, 1988--June 30, 1988.** Ertekin, T. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Engineering). 1988. Contract FG22-87PC79927. 21p. NTIS, PC A03/MF A01. Order Number DE89002263/JAW.

During the previous quarter, mathematical development for single-phase flow of methane in coal seams has been completed. Furthermore, single-phase and two-phase flow equations were expressed in dimensionless groups. Finally, a preliminary analytical solution for single-phase flow was developed. 4 refs., 8 figs., 2 tabs.

2767 **(PB—88-240544/XAB) Coal extraction, transport, and logistics technology for underground mining. Information Circular/1988.** Evans, R.J.; Mayercheck, W.D. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1988. 90p. (BM-IC—9181). NTIS, PC A05/MF A01.

Library of Congress catalog card no. 87-600440.

The Bureau of Mines is sponsoring a variety of long-term, high-risk research to advance state-of-the-art technology in U.S. underground coal mining. This report reviews the status of many Bureau projects that support fundamental underground coal-mining operations; the project areas include cutting coal from the solid (extraction), hauling coal from the face (transport), and activities that sustain daily operations (logistics). Innovative equipment and technology have been developed, with these major objectives: to significantly improve coal-mine productivity, to further advance coal recovery and personal safety within the mining industry, and to reduce the time needed to develop longwall panels. The majority of the prototype equipment covered in the report either has undergone or will undergo comprehensive evaluation at Bureau surface test facilities so that performance and reliability can be improved before the equipment is tested and evaluated in a working section underground.

2768 **(PB—88-240585/XAB) Investigation of dust sources and control technology for longwall plow operations. Information Circular/1988.** McClelland, J.J.; Jankowski, R.A. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1988. 17p. (BM-IC—9173). NTIS, PC A03/MF A01.

See also PB—84-142058. Library of Congress catalog card no. 87-600333.

This document reports a study of longwall plow operations to identify dust sources and existing control technology. Three longwalls employing either the high-speed overtaking or conventional method of mining were surveyed. Principal operating parameters and on-site dust-control technology at the time of each survey are described. Short-term gravimetric and instantaneous sampling results are discussed in detail. The relationship between longwall dust levels and dust-control technology was examined.

2769 **(PB—88-241922/XAB) Instrumentation to monitor subsidence associated with high-extraction mining in the Illinois coal basin. Final report, October 1985-May 1987.** Huck, P.J.; Bhattacharya, S. (Engineers International, Inc., Westmont, IL (USA)). Jun 1988. 61p. (EI—1258). NTIS, PC A04/MF A01.

Prime cropland and underground coal reserves constitute two significant natural resources in the state of Illinois. Utilization of both agricultural and mineral resources suggests the development of high-extraction-mining methods which minimize damage to the overlying croplands. Several Illinois agencies have therefore instituted a program to study high-extraction-mining methods in an effort to characterize surface damage caused by subsidence. In support of the program, Engineers International, Inc. undertook a program from the U.S. Bureau of Mines, Twin Cities Research Center, to select and emplace appropriate subsidence instrumentation over a high-extraction mine panel selected by the cooperating Illinois state agencies. This instrumentation was to provide subsidence data for both short and long-term subsidence and hydrological effects of mining. The emplaced instrumentation included multipoint borehole extensometers (MBPX), observation wells, piezometers, subsidence monuments, and control monuments to provide local horizontal and vertical control. A suite of laboratory tests was conducted on specimens recovered during drilling, and rock-properties data were culled from published and Engineers International, Inc. file data.

2770 **(PB—88-248679/XAB) Coal dust control by condensation enlargement. Progress report.** Schowengerdt, F.D.; Brown, J.T. (Colorado School of Mines, Golden (USA). Dept. of Physics). 30 Jun 1982. 37p. NTIS, PC A03/MF A01.

A prototype dust-conditioning system for control of coal dust was designed, constructed, and evaluated, based on the concept of condensation enlargement. The volume of the device was 0.74 cubic feet and it was designed to handle up to 50 cubic feet per minute (cfm) of dust laden air. Nucleation efficiencies of 95% were measured, resulting in overall mass removal efficiencies greater than 99% at flow rates of 10 cfm. At 50 cfm, the efficiency dropped to 80%. The device was able to be scaled to a capacity of 3000 cfm, sufficient for a full-scale mining application. The authors suggest that a geometric configuration of a concentric cylindrical shape with the outer cylinder being cooled and heat introduced along the inner cylinder should be examined as this would have some advantages over the present plane geometry used in the prototype.

2771 **(RI—9096) Water infusion for coal mine dust control: Three case studies.** McClelland, J.J; Organiscak, J.A.; Jankowski, R.A.; Pothini, B.R. (Bureau of Mines, Pittsburgh, PA (USA)). 1987. 17p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

This Bureau of Mines report discusses recent applications of water infusion technology to control dust in U.S. coal mines and presents recommended guidelines for determining coal seam infusibility. The techniques required to use water infusion are presented in detail. A Bureau case study indicated that water infusion reduced dust levels by 68 pct along a longwall plow face, bringing this section into compliance with the 2.0-mg/m/sup 3/ Federal dust standard.

0130 Transport And Handling

2772 **(UCID—20297-88-1) Granular solids flow project: Quarterly report, January--March 1988.** Walton, O.R. (ed.). (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 11p. NTIS, PC A03/MF A01. Order Number DE89001558/JAW.

During the current funding period we have continued to develop and utilize our computer models for simulating rapid shearing flows of cohesionless, dry granular solids and have also continued to develop techniques to model interstitial fluid effects. We report developments in two areas. First is the implementation of a significantly more efficient rigid-sphere model that utilizes inelastic and frictional collisions including the effects of particle rotational motion and its application to rapid shearing flow simulations. The new model is able to reproduce rapid shearing flow results obtained with previous slightly-deformable-particle models with about a factor of 50 or so improvement in calculational efficiency. This model is also providing new insight into how details of rotational interactions during collisions affect bulk material flow behavior. Second is a continuation of our collaboration with researchers at UCLA conducting inclined channel flow tests. Direct simulation of those tests provides validation of our models by direct comparison with gravity flows involving complex boundary conditions, and further, it provides significant insight into the effects various parameters have on the experimentally observed flows. The simulations have been particularly useful in determining the significance of boundary and air drag forces on the observed velocity profiles in these nearly two-dimensional channel flows. Some of our previous simulations of those tests used an incorrect spacing between the two vertical glass side walls of the channel and required inclusion of an "enhanced" air drag term in order to obtain mass flow rates as low as those measured in the laboratory. New calculations with the correct gap width give significantly lower mass flow rates. 19 refs., 3 figs.

0140 Combustion

REFER ALSO TO CITATION(S) 2748, 2757, 2785, 3294

2773 **(DOE/FC/10615—2610) Low-rank coal combustion studies for gas turbine applications: Final report.** Rosfjord, T.J. (United Technologies Research Center, East Hartford, CT (USA)). Feb 1988. Contract AC21-84FC10615. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88010272/JAW.

Coal-based fuels may represent a future source of gas turbine fuels. The particular notion of directly-firing the combustor on either a dry powder or a water slurry could be economically attractive because the reduced fuel processing. Data have been acquired for five fuels containing sub-bituminous coal and one using a lignite. Sub-bituminous fuels were coal-water mixture differing in either the coal processing or coal loading. One slurry was based on minimally-processed coal. The other four presented different loading of an improved-quality form of the same parent coal; slurry loadings up to 55 pct were achieved, providing nearly 50-pct greater heating value than the minimally-processed fuel. Lignite was also processed to produce an improved-quality slurry. Attempts to deliver and combust powdered, sub-bituminous coal were not successful. All tests were performed in a combustor configured to achieve geometrically separated zones of fuel-rich and fuel-lean combustion. A lower limit of fuel energy density was necessary to sustain stable combustion; efficiencies greater than 95 pct were only achieved for improved-quality fuels. For the stages combustor used, a fuel lower heating value of 5000 Btu/lb was required. 8 refs., 29 figs., 3 tabs.

2774 **(DOE/MC/21172—2637) Advanced atmospheric fluidized-bed combustion design---spouted bed: Final report.** (Battelle Columbus Div., OH (USA)). Feb 1988. Contract AC21-84MC21172. 133p. NTIS, PC A07/MF A01. Order Number DE89000913/JAW.

The spouted fluidized bed (SFB) is a hybrid of the spouted bed and the conventional fluidized bed. Because of the bed dynamics and the increased particle attrition in the spout zone the SFBC

is expected to provide benefits over conventional fluidized bed combustor (FBC) including improved fuel flexibility, better sorbent utilization and lower gaseous emissions compared to a conventional FBC. Results of the experimental program demonstrated consistent incremental performance advantages for the SFBC compared to the conventional FBC when burning 1/4-3/4 in. coal with 0-1/2 in. limestone. These advantages include lower SO_2 emissions and lower NO/sub x/ emissions. In both cases the performance advantage for the SFBC increased significantly as the coal size and limestone size increased. Limited performance data are available for the large particle systems. The CO emissions were slightly higher for the SFBC than the conventional FBC. 9 refs., 7 figs., 10 tabs.

2775 **(DOE/PC/70794—8) The effect of energy feedback mechanisms on the oxidation rate of pulverized coal: Final technical report, September 1, 1984-August 31, 1986.** Haussmann, G.; Krewson, S.; Kruger, C.H. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Nov 1986. Contract FG22-84PC70794. 85p. NTIS, PC A05/MF A01. Order Number DE88016194/JAW.

The rate of overall oxidation to gas-phase species of pulverized Montana Rosebud subbituminous coal has been measured in the Stanford flow-tube reactor. In this reactor nearly isothermal conditions and well controlled oxygen concentrations, along with the use of narrowly size-graded coal samples has allowed the isolation and independent study of the important reaction parameters. Gas temperatures of 1150, 1450, and 1750K have been studied, along with a range of oxygen concentrations from 0.0% to 15.0%, and nominal particle diameters of 40, 55, and 65 μm. Along with measuring gas-phase species (CO, CO_2 and light hydrocarbons) to determine the extent of carbon conversion as a function of residence time, partly-reacted particles were collected and analyzed through a number of techniques. The measurements made include bulk densities, quantitative internal void volumes measured through analysis of cross-section micrographs, and analysis of the carbon, hydrogen, oxygen and ash content. Qualitative information is obtained through scanning electron microscopy and from the cross-section micrographs. Results are discussed. 26 refs., 55 figs., 7 tabs.

2776 **(DOE/PC/79913—T3) Aerated atomization of coal-water slurry: Quarterly technical progress report, April 1, 1988--June 30, 1988.** Buckner, H.N.; Sojka, P.E.; Lefebvre, A.H. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). 11 Jul 1988. Contract FG22-87PC79913. 12p. NTIS, PC A03/MF A01. Order Number DE89002245/JAW.

In order to better understand the process of slurry atomization, it is important to observe the influence of fluid non-Newtonian rheological behavior on the spray formation process. As a first step, glycerin-water solutions have been atomized. The results show excellent atomization in the annular flow regime, but exhibit a significant amount of scatter in the data; therefore, the results are not conclusive. 4 figs., 4 tabs.

2777 **(DOE/PC/80263—12) Investigation of the combustion properties of micronized coal: Quarterly technical progress report for the period April 1, 1988--June 30, 1988.** Freihaut, J.D.; Vranos, A.; Proscia, W.M.; Knight, B. (United Technologies Research Center, East Hartford, CT (USA)). 1988. Contract AC22-85PC80263. 34p. NTIS, PC A03. Order Number DE89001593/JAW.

An extensive investigation of the "formation" of ash aerosol during the devolatilization of micronized coal feeds was performed using an entrained flow devolatilization reactor having an unique aerosol phase separation system. The formation of submicron ash particles in the fuel rich stage of high intensity combustion devices is of concern from either a combustor erosion perspective or the creation of an exhaust effluent health hazard. Tests were performed with beneficiated and unbeneficiated micronized samples of a VA bituminous coal. Tests were also performed with aerodynamically-sized micronized coal sample having no associated fines. Employing a unique FT-IR technique to measure the concentration of ash aerosol found at each aerosol separation stage it was determined that the devolatilization process does not create significant amounts of ash aerosol during devolatilization at temperatures below 1000 C. Aerosol mineral matter observed simply reflects the independent aerosol mineral distribution found in the parent feed. Only trace amounts of colloidal or organically complexed mineral species are found convected with the tar species 22 figs., 5 tabs.

2778 **(DOE/PC/88859—T1) Formation and destruction of nitrogen oxides in coal combustion: Quarterly report, January 26, 1988--March 31, 1988.** Chen, Wei-Yin; Lester, T.W.; Wang, Xiang-Yun; Cheng, Man-Ting; Babcock, L. (Louisiana State Univ., Baton Rouge (USA)). 1988. Contract AC22-88PC88859. 18p. NTIS, PC A03/MF A01. Order Number DE89001384/JAW.

This program addresses the sequential elucidation of the reactions (mechanism, thermodynamics and kinetics) between fuels (coal, oil and gas) and flue gases under fuel-rich conditions. The program simulates the reburning environment of a coal-fired boiler to identify reaction pathways of the nitrogen compounds (in the fuel and flue gas). For environmental reasons, the project aims at demonstrating reduced emission of total fixed nitrogen (all nitrogen compounds except N_2) based on both experimental evidence and theoretical analyses. It is anticipated that this quantitative analysis will provide specific engineering recommendations for control of NO/sub x/ by reburning. 12 refs., 3 figs.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 2757, 2792, 2793, 2794, 3060

2779 **(DOE/EIA—0121(88/2Q)) Quarterly coal report, April--June 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 3 Nov 1988. 140p. NTIS, PC A07/MF A01 - GPO. Order Number DE89002701/JAW.

Coal production in the first half of 1988 totaled 463.4 million short tons, up 5.1 percent from the 441.0 million short tons produced during the first six months of 1987. A great part of this increase can be attributed to a rise in the demand for electricity during the first half of 1988. Most of the additional coal production occurred in the Western Region, where production was up by 18.6 million short tons. Every major coal-producing state in the Region had a production gain, with Wyoming and Montana leading the way. Montana's production rose by 35.0 percent (5.0 million short tons) over this period, due in large part to coal severance tax incentives and increased demand by coal-fired electric utility plants in Montana. Wyoming's coal production rose by 11.6 percent (7.9 million short tons) in this period, due in part to the rising demand for coal-generated electricity in states west of the Mississippi River. Coal production for all of 1988 is expected to increase 2.4 percent, to 940.9 million short tons, as the production pace slows relative to last year's fourth quarter output. This would be record production for the second year in a row. Coal production in 1989 is projected to rise by an additional 0.5 percent, to 945.6 million short tons. These levels of production are based on the projected increases in coal consumption by electric utilities for these years. 16 figs., 70 tabs.

0160 Health And Safety

REFER ALSO TO CITATION(S) 2798

2780 **(PB—88-240536/XAB) Probe-hole drilling: high-stress detection in coal. Information Circular/1988.** McDonnell, J.P.; Haramy, K.Y. (Bureau of Mines, Denver, CO (USA). Denver Research Center). 1988. 18p. (BM-IC—9179). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-600003.

Coal-mine bounces and bursts are major problems facing U.S. mine operators. Bounces and bursts have the potential to inflict severe injury on mining personnel, damage equipment, and cause mine closures. High-stress conditions, at or near the working face, are the common denominator in the burst problem. If mine operators can locate high-stress and potentially burst-prone zones, they can then use stress-relief methods to control the burst condition. One method of locating the high-stress zone is the probe-hole-drilling or drilling-yield method. Probe-hole drilling is used fre-

quently in Europe, the U.S.S.R., and Japan as a means for locating potential burst zones. Consequently, the Bureau of Mines performed tests in the laboratory and in a deep, burst-prone western mine to analyze probe-hole drilling.

2781 **(PB—88-247580/XAB) Cellular response to coal in vitro cwp (coal workers pneumoconiosis). Final report.** Christian, R.T.; Elia, V.J.; Cody, T.E.; Menefee, M.G.; Bell, M. (Cincinnati Univ., OH (USA)). 1979. 11p. NTIS, PC A03/MF A01.

Coal Workers Pneumoconiosis (CWP) was studied at the cellular levels using samples of Pennsylvania (PC) and Utah (UC) coal placed in contact with cultured mammalian cells. The growth of mammalian cells was depressed by both types of coal, with the depression caused by PC being much greater. The concentration of nickel in leachates compared most closely with biological activity. There may be more occurrences of CWP in workers exposed to PC than UC not only because PC coal has more respirable particles, but also because the leachate substances appear to be more toxic. The hydroxyproline level of cell-layer collagen was decreased when the cells were exposed to coal leachates. An accumulation of collagenous tissue is found in the lungs of miners suffering from CWP. Human-lung fibroblasts in culture produced increased amounts of collagen fibers when treated with a substance known to enhance collagen synthesis in-vivo. Collagen seen in the lungs of miners suffering from CWP may arise by a different process or as a secondary response to damage in the lung.

2782 **(PB—88-247671/XAB) Evaluation of the potential health effects of occupational exposure to diesel exhaust in underground coal mines.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 24 Mar 1986. 149p. NTIS, PC A07/MF A01.

Studies of the effects of exposure to diesel exhaust and solvent extracts of diesel exhaust on bacterial/cell cultures, animals, and humans were reviewed in relation to the potential for adverse health effects of exposures in underground coal mines. The composition of diesel exhaust was delineated and areas for additional studies of possible health effects were identified. Studies have demonstrated that some of the components of diesel exhaust cause mutations in microorganisms and cancer in animals. Health effects ranging from eye irritation to respiratory disease in humans have been reported. According to the authors, NIOSH cannot definitively affirm or condemn the use of diesel equipment in underground-mining operations at this time. Exposures should be kept below the Mine Safety and Health Administration standards, or NIOSH recommended exposure limits.

2783 **(RI—9088) Indices of mine safety resulting from the application of the Poisson distribution to mine accident data.** Kerkering, J.C.; McWilliams, P.C. (Bureau of Mines, Pittsburgh, PA (USA)). 1987. 31p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

The Bureau of Mines used mathematical reliability theory to define, for use in the mining industry, the concepts of risk, safety, reliability, hazard, and mean time between accidents. In this report, the definitions are explained theoretically and illustrated by application to actual underground mine accident data extending over a 9 1/2-year period. The theoretical development proceeds along two parallel analytical paths. For each line of reasoning, the data are presumed to be independent. If they are not, the analysis stops, although there are interesting implications when dependency is demonstrated. The first method uses the elapsed times between accidents as the basic data. The second method uses the maximum likelihood estimator to formulate a Poisson distribution function for the data. The function is tested for adequacy by a goodness-of-fit test; if the fit is acceptable, the Poisson function is used to define the concepts. Both methods were applied to the data base, yielding nearly identical results.

02 PETROLEUM

0201 Reserves

2784 **(DOE/EIA—0216(87)) US crude oil, natural gas, and natural gas liquids reserves: 1987 annual report.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 27 Oct 1988. 104p. NTIS, PC A06/MF A01 - GPO. Order Number DE89002698/JAW.

As of December 31, 1987, proved reserves were estimated to be 27,256 million barrels of crude oil; 187,211 billion cubic feet of dry natural gas (excluding gas in underground storage); and 8147 million barrels of natural gas liquids (including lease condensate). Proved reserves are those that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. During 1987, proved reserves of crude oil increased by 1.4 percent or 367 million barrels. This increase was principally due to the largest positive revision (3687 million barrels) ever recorded by EIA. Very large positive revisions (1121 million barrels) occurred in Alaska because of infill drilling, enhanced recovery, and reassessment of field performance. Large upward revisions were also reported in the lower 48 states, primarily due to expansion of heavy oil thermal recovery projects in California (505 million barrels) and enhanced recovery projects in West Texas (477 million barrels). These revisions were supported by improved economic conditions as the average US crude oil price increased from $12.51 per barrel for 1986 to $15.41 for 1987. Each year there are also substantial revision decreases and other adjustments to reserves. Combined, the reserve adjustments and revisions added 2549 million barrels to the 1987 crude oil reserve base, nearly 3 times the 1986 volume and roughly twice the 1977 through 1986 annual average of 1426 million barrels. 27 refs., 9 figs., 15 tabs.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 2787, 3560

0203 Drilling And Production

2785 **(ANL/CNSV-TM—204) An experimental program to test the feasibility of obtaining normal performance from combustors using oxygen and recycled gas instead of air.** Abele, A.R.; Kindt, G.S.; Clark, W.D.; Payne, R.; Chen, S.L. (Argonne National Lab., IL (USA); Energy and Environmental Research Corp., Irvine, CA (USA)). Dec 1987. Contract W-31109-ENG-38. 177p. NTIS, PC A09/MF A01. Order Number DE89002383/JAW.

Injection of carbon dioxide (CO_2) can be used to increase the production from oil wells. The recovery of oil is enhanced by pumping CO_2 into oil reservoirs at pressure to dissolve the CO_2 in the oil. This causes the oil to expand as well as decreasing its viscosity and surface tension. The viscous oil can then be more easily recovered from the oil wells. This recovery process requires CO_2 gas that is at least 90 percent pure. One plentiful source of CO_2 is fossil fuel combustion, such as industrial and utility boilers. Ordinarily, the products from the combustion of fossil fuels with air is only about 15 percent CO_2, with the balance being mostly nitrogen, 8--10 percent water vapor, 3--5 percent O_2, and trace quantities of NO/sub x/ and SO_2. Conventional approaches to recovering CO_2 from combustion sources utilize various processes to separate CO_2 from the stack gas. Disadvantages to such separation techniques include: (1) the relatively low concentration of CO_2 in the stack gas and (2) the presence of gaseous species (O_2 and SO/sub x/) which may interfere with the separation process. These issues, and the measures to resolve them, tend to increase the cost of the separation process. 8 refs., 44 figs., 32 tabs.

2786 **(DOE/BC/10815—2546) Corrosion protection of Arctic offshore structures: Final report.** Sackinger, W.M.; Rogers, J.C.; Feyk, C.; Theuveny, B. (Alaska Univ., Fairbanks (USA). Geophysical Inst.). Oct 1985. Contract AS21-83BC10815. 183p. NTIS, PC A09. Order Number DE88001044/JAW.

Results are presented for a research program on corrosion prevention for Arctic offshore structures which are in contact with sea ice for a significant portion of the year. The electrical method most adaptable for structure protection involves the injection of impressed current from several remote anodes buried just beneath the sea floor. The electrical resistivity of annual sea ice as a function of temperature and salinity is presented. Details of the interface layers formed between sea ice and steel in the presence of current injection are shown. A computer program was developed to enable the calculation of protective current density into the structure, in the presence of ice rubble and ridges around the structure. The program and the results of an example calculation are given for a caisson- retained island structure. 81 refs., 103 figs., 3 tabs.

2787 **(NIPER—320) National Institute for Petroleum and Energy Research, 1987 annual report.** Ball, J.S. (ed.). (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 542p. NTIS, PC A23/MF A01. Order Number DE88001234/JAW.

This report covers activities during the fourth year of a five year cooperative agreement with the Department of Energy (DOE). The organization is divided into two research departments: Energy Production Research and Fuels Research. The Energy Production Research Department has, as its principal DOE program, research and development on enhanced oil recovery technology, whereas the Fuels Research Department is largely concerned with the effect on both processing and utilization of the changing of feedstocks from predominantly light petroleum crudes to include alternative crudes produced from heavy oils, tar sand liquids, shale oil, and coal liquids. 41 projects are described and entered separately into the data bases.

2788 **Calorimetric studies of amphiphile/oil/water systems for enhanced oil recovery.** Dunn, R.O.; Das, K.; Covatch, G.; Smith, D.H. (Enhanced Oil Recovery Group, U.S. Dept. of Energy, Morgantown Energy Technology Center, Morgantown, WV (US)). *American Chemical Society, Division of Petroleum Chemistry. Preprints;* **33**: No. 1, 157(May 1988). (CONF-880659—).

From ACS symposium on advances in oil field chemistry; Toronto, Canada (5 Jun 1988).

Better experimental methods and new types of data are needed for the measurement and prediction of the phase behavior of amphiphile/oil/water systems used in various types of enhanced oil recovery (EOR), including both dispersion-based mobility control for "gas" flooding (emulsions and foams), and high-capillary number EOR. This paper reports progress in the use of titration calorimetry (both isoperibolic and isothermal) for the measurement of phase diagrams of cosurfactant/n-alkane/water systems. The cosurfactants studied included alcohols and low molecular weight ethoxylated alcohols. Compositions of triconjugate (lower-, middle-, upper-phase systems) were obtained without conventional compositional analyses by thermal detection of compositions at which the number of phases changed from two to three, linear regressions to get the limiting tielines, and calculation of the tietriangle corners from the interceptions of the equations for the limiting tielines. The first measurements of the heats of formation of triconjugate phases in these types of systems are also reported.

0205 Products And By-products

REFER ALSO TO CITATION(S) 2787

2789 **(AD-A—196582/1/XAB) Alternate fuels for general-aviation aircraft with spark-ignition engines. Final report.** Ferrara, A.M. (Federal Aviation Administration, Atlantic City, NJ (USA). Technical Center). Jun 1988. 95p. (DOT/FAA/CT—88/05). NTIS, PC A05/MF A01.

This report describes the results of a study into the behavior of several alternate fuels that are under consideration for use in general aviation aircraft engines. The study consisted of a literature search and engine tests using a dynamometer. The literature search identified material compatibility problems and possible solutions to these problems. For the engine tests, a number of gasoline/alcohol blends were prepared using both ethanol and methanol in varying concentrations and the vapor-lock behavior was identified. Neat alcohols and methyl-tertiary-butyl ether were also used in the engine, and special operational conditions and problems were identified.

2790 **(AD-A—196634/0/XAB) Study of variables affecting results in the D2274 accelerated stability test. Part 2. Effects of selected chemical variables. Research and development report.** White, E.W. (David Taylor Research Center, Bethesda, MD (USA). Ship Materials Engineering Dept.). Apr 1988. 48p. (DTRC/SME—88/08). NTIS, PC A03/MF A01.

Different laboratories have been unable to obtain comparable stability results on a fuel sample when the ASTM D2274 test procedure has been used. This center is attempting to identify critical variables that causes inconsistencies. Five chemical variables were examined that included: oxygen purity, residual acidity, metallic contacts, copper concentrations, and exposure to ultraviolet light. Experiments with nitrogen, air, and oxygen show that insolubles increase with oxygen concentration. Other experiments show that acidity, iron oxide, iron-copper coils, ultraviolet radiation, and increasing levels of cupric acetyl acentonate yield increasing amounts of insolubles. The general conclusion is that the samples should not be shipped in contact with metallic or rusty cans; they should not be exposed to light during sampling, shipping, or laboratory testing; and they should not contact copper-containing metals. Further, laboratory personnel should ensure that all traces of acidic cleaning compounds are removed from glassware and that only high purity oxygen is used.

2791 **(AD-A—196784/3/XAB) Mechanism of inhibition of knock by lead additives, a chain-debranching reaction.** Benson, S.W. (University of Southern California, Los Angeles (USA). Loker Hydrocarbon Research Inst.). 1988. 5p. NTIS, PC A02/MF A01.

Pub. in the Jnl. of Physical Chemistry, Vol. 92, No. 6, 1531-1533(1988).

Detailed catalytic cycles leading to chain debranching (radical depletion) are proposed to account for the behavior of Pb in inhibiting hot ignition. On the basis of estimates of heats of formation and bond dissociation energies of various lead-containing species with oxygen and hydrogen it is shown that each step in the cycle is expected to be rapid and exothermic. It is also shown that the inhibiting activity of Pb is restricted to the temperature regime between 800 and 1100 K. Chain debranching is a new phenomenon, which may play an important role in other radical chain reactions. Olefin radicals produced in secondary combustion reactions may act as alternate branching agents.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 3060

2792 **(DOE/EIA—0202(88)) Short-term energy outlook annual supplement, 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 4 Nov 1988. 60p. NTIS, PC A04/MF A01 - GPO. Order Number DE89002699/JAW.

The Energy Information Administration (EIA) publishes forecasts of short-run energy supply, demand, and prices in the {ital Short-Term Energy Outlook (Outlook)} on a quarterly basis. This report serves as an annual supplement to that report and discusses major changes in the forecasting methodology, analyzes previous forecast errors, makes comparisons with other energy forecasters, and examines current energy issues that affect the forecasts. The principal users of this supplement are managers and energy analysts in private industry and government. 40 tabs.

2793 **(DOE/EIA—0219(87)) International energy annual, 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 6 Oct 1988. 141p. NTIS, PC A07/MF A01 - GPO. Order Number DE89002414/JAW.

The principal sources of the world's primary energy were liquid fuels (crude oil and natural gas liquids), natural gas, coal, and electricity from hydropower and nuclear power. Measured in British thermal units (Btu), world production of primary energy exceeded 321 quadrillion (10^{15}), Btu in 1987. Crude oil and natural gas liquids accounted for about 40 percent of total world energy output or 127 quadrillion Btu. Coal production contributed over 28 percent of the world's total energy output or 90 quadrillion Btu. Dry natural gas production accounted for 20 percent or nearly 66 quadrillion Btu. Hydroelectric power accounted for nearly 7 percent of total energy or 21 quadrillion Btu followed by nuclear electric power at more than 5 percent or 17 quadrillion Btu. In 1987 liquid fuels accounted for 31 percent of the US output as compared to 38 percent of the USSR output. Coal contributed 31 percent of the US energy output but only 21 percent of the USSR output. Dry natural gas production accounted for 26 percent of the US total energy but as much as 35 percent of the USSR total energy output. Nuclear electric power production contributed 8 percent of the US energy output with hydroelectric power contributing 4 percent of the Nation's total energy output. On the USSR hydroelectric power and nuclear electric power each constituted about 3 percent of the total energy output of that nation. 21 figs., 40 tabs.

2794 **(DOE/EIA—0376(86)) State energy price and expenditure report, 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 28 Oct 1988. 246p. NTIS, PC A11/MF A01 - GPO. Order Number DE89002415/JAW.

The average price paid for energy in the United States in 1986 was $7.19 per million Btu, down significantly from the 1985 average of $8.42 per million Btu. While total energy consumption increased slightly to 74.3 quadrillion Btu from 1985 to 1986, expenditures fell from $445 billion to $381 billion. Energy expenditures per capita in 1986 were $1578, down significantly from the 1985 rate. In 1986, consumers used only 94 percent as much energy per person as they had in 1970, but they spent 3.9 times as much money per person on energy as they had in 1970. By state, energy expenditures per capita in 1986 ranged from the lowest rate of $1277 in New York to the highest of $3108 in Alaska. Of the major energy sources, electricity registered the highest price per million Btu ($19.00), followed by petroleum ($5.63), natural gas ($3.97), coal ($1.62), and nuclear fuel ($0.70). The price of electricity is relatively high because of significant costs for converting energy from various forms (e.g., fossil fuels, nuclear fuel, hydroelectric energy, and geothermal energy) into electricity, and additional, somewhat smaller costs for transmitting and distributing electricity to end users. In addition, electricity is a premium form of energy because of its flexibility and clean nature at energy consumers' sites.

2795 **(DOE/EIA—0380(88/08)) Petroleum marketing monthly, August 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 3 Nov 1988. 172p. NTIS, PC A08/MF A01 - GPO. Order Number DE89002700/JAW.

Worldwide crude oil markets were generally quiet in August. Prices gradually declined throughout the month, except for a brief upward surge following news of the United Nations sponsored cease-fire which ended, at least temporarily, the armed conflict between Iran and Iraq. Some members of the Organization of Petroleum Exporting Countries (OPEC), continued to boost their own production to bolster their negotiating positions in future quota disputes. Although production increases had become a clear threat to prices by the end of the month, the continued hope of OPEC action to save the quota system appeared to forestall a collapse of the market. In the United States, the composite refiner acquisition cost of crude oil fell 39 cents (2.7 percent) to $14.32 per barrel in August. While motor gasoline sales were flat, substantial increases in sales of No. 2 and residual fuel oils and propane led to a 2.2 percent overall increase in refiner sales of the major petroleum products. This was accompanied by a rise in refiner retail motor gasoline prices of 1.9 cents per gallon (2.7 percent). 12 figs., 53 tabs.

2796 **(DOE/EIA—0487(87)) Petroleum Marketing Annual, 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 31 Oct 1988. 370p. NTIS, PC A16/MF A01 - GPO. Order Number DE89002703/JAW.

In world crude oil markets, 1987 was a year of limited recovery and relative stability after the dramatic price slide of early 1986. Both foreign and domestic crude thereafter, ending the year somewhat higher than a year ago. In contrast, product wholesale markets remained relatively stable throughout the year, while retail prices sustained a fairly steady increase. As has been the case for over a decade, major price movements in international oil markets generally reflected responses to actual or perceived changes in the policies of the Organization of Petroleum Exporting Countries (OPEC) and/or its members. The year began with prices on an upward trend, in reaction to the December 1986 OPEC meeting in which the members resolved to return to an official pricing structure (a departure from the market-based pricing of 1986), and to reduce output quotas. Prices continued to rise until August, when evidence of continued OPEC overproduction appeared to outweigh market optimism, triggering a gradual slide that lasted the remainder of the year. Even with the downturn in the fourth quarter, crude oil markets in 1987, as measured by refiner acquisition costs, finished the year, above year-end 1986 levels, and considerably above the lows reached in mid-1986. OPEC's struggle to maintain stable prices and production levels in 1987 reflected the organization's difficulties in reaching and enforcing agreements among its politically and economically diverse membership. 11 figs., 49 tabs.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 2787, 3495

2797 **(PB—88-241856/XAB) Cleanup of releases from petroleum USTS (underground storage tanks): selected technologies.** Noonan, D.C. (Camp Dresser and McKee, Inc., Boston, MA (USA)). Apr 1988. 120p. NTIS, PC A06/MF A01.

The handbook provides engineering-related information on costs, efficiencies, and limitations of corrective-action technologies aimed at removing petroleum-related contaminants (principally associated with gasoline) from the subsurface. While many technologies exist for the cleaning of soil, air, and water, only a limited number possess demonstrated performnce records and have progressed to full-scale applications. The handbook concentrates on those technologies that have been widely applied.

0240 Storage

REFER ALSO TO CITATION(S) 2797

2798 **(PB—88-242045/XAB) Health and safety guide for bulk petroleum plants. Fact sheet.** Sundin, D.S.; Seta, J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Sep 1974. 87p. (DHEW/PUB/NIOSH—75-112). NTIS, PC A05/MF A01.

This Safe practices guide is based in part on the Occupational Safety and Health Standards promulgated by the United States Department of Labor and published under Title 29 of the Code of Federal Regulations 29 CFR 1910. Contents include: Job safety and health guidelines; The bulk plant; Lifting; Walking and working surfaces; Exit markings; Sanitary facilities; Medical and first aid; Personal protection; Fire prevention; Safety warehousing; Portable handtools; Machine guarding; NIOSH and OSHA regional offices; and Emergency information.

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 2784

0302 Geology And Exploration

2799 **(PB—88-250618/XAB) Comprehensive review of selected wells surrounding Staged Field Experiment No. 2, North Appleby Field, Nacogdoches County, Texas. Topical report, January-July 1987.** Holditch, S.A.; Robinson, B.M.; Whitehead, W.S.; Sullivan, R.B. (Holditch (S.A.) and Associates, Inc., College Station, TX (USA)). Jul 1988. 84p. NTIS, PC A05/MF A01.

The GRI Staged Field Experiment (SFE) No. 2 well was drilled on acreage farmed in from Amoco Production Co. in the North Appleby Field, Nacogdoches County, Texas. To prepare for drilling, completing, and testing SFE No. 2, production data, pressure buildup data, logs, fracture-treatment records, and other well data from several wells in the area have been thoroughly analyzed. From the analyses of the available data, the in-situ permeability of gas in the area of the North Appleby Field near the site of SFE No. 2 was estimated to be 0.01-0.08 md. Propped fracture lengths in the three Amoco wells studied were 100-200 feet long with fracture conductivities averaging only about 50 md-ft. It was determined that if the wells could drain 80 acres and if propped fractures could be achieved which were 500 feet long with a conductivity of 500 md-ft, gas recovery could be improved by almost 20 percent.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 2802

2800 **(PB—88-250600/XAB) Significance of geology to gas production from Devonian shales of the central appalachian basin: an underdeveloped asset. Topical report, October 1987-July 1988.** Hamilton-Smith, T. (K and A Technology, Tulsa, OK (USA)). Jul 1988. 132p. NTIS, PC A07/MF A01.

Devonian and Lower Mississipian shales of the central Appalachian basin produce gas from various fine-grained reservoirs enhanced by natural fracturing. Fracture development was due to Alleghenian reactivation of basement faults in the autochthonous terrane north of the Allegheny Front and west of the Burning Springs-Mann Mountain detachment. Basement faults were inherited both from the Grenville orogeny and from Rome Trough rifting during the opening of the Iapetus Ocean. Deposition occurred in two successive foreland basins of the Acadian orogeny, restricted to the west by the Cincinnati Arch and filled from the east by the synorogenic deposits of the Catskills Delta. Deep burial in the Permian and hydrothermal flow from basement faults produced variable degrees of thermal maturation of kerogen encompassing the oil window. Reservoirs range from fine-grained sandstones to fractured black shales. Aside from fracture development, black shale production is constrained by gas desorption from kerogen and permeability reduction due to blocking by trapped oil. Recommendations are made for effective geological contributions to gas production.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 2792, 2793, 2794, 3060

2801 **(DOE/EIA—0131(87)/2) Natural gas annual 1987: Volume II.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 25 Oct 1988. 231p. NTIS, PC A11/MF A01 - GPO. Order Number DE89002413/JAW.

The Natural Gas Annual provides information on the supply and disposition of natural gas to a wide audience including industry, consumers, Federal and State agencies, and educational institutions. This report, Volume II, presents historical data for the Nation from 1930 to 1987, and by State from 1967 to 1987. 21 refs., 4 figs., 23 tabs.

0309 Artificial Stimulation

2802 **(DOE/MC/22000—2633) Two-phase flow in tight sands: Final report.** Chowdiah, P. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1988. Contract FG21-85MC22000. 118p. NTIS, PC A06/MF A01. Order Number DE88010293/JAW.

The objective of this project was the development of equipment and laboratory techniques for measuring properties of tight sands that are needed for two-phase computer simulation of production. As such, emphasis has been on equipment and techniques to determine, as a function of water saturation and under net stresses representative of in-situ stress levels, variations in capillary pressure, permeability to gas, and permeability to water. 20 refs., 18 figs., 8 tabs.

2803 **(PB—88-240510/XAB) Review of membrane technology for methane recovery from mining operations. Information Circular/1988.** Garcia, F.; Cervik, J. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1988. 12p. (BM-IC—9174). NTIS, PC A03/MF A01.

The development of membranes for gas separation is reviewed, along with the theory of how they work, and their application to the separation of methane from air and associated problems. Methane-air mixtures are difficult to separate with membranes because the pertinent gas couples, O_2-N_2, O_2-CH_4, and N_2-CH_4, have poor-separation characteristics, as indicated by their separation factors of about 3 or less. Even if these separation factors were substantially higher, there is doubt that methane could be recovered economically from the low concentrations in mine ventilation exhaust (2 vol pct or less). The exhaust pressures are not sufficient for adequate separation. The power cost of compressing these mixtures would far exceed the value of the methane recovered. New discoveries could make separation of gob-hole methane-air mixtures practical. These mixtures have much higher concentrations of methane (from 30 to 100 vol pct); however, for safety reasons, treatment would be limited to gob gas with 60 vol pct CH_4 or more.

0330 Properties

2804 **(PB—88-250584/XAB) Thermophysical properties of fluids for the gas industry: speed of sound of natural gases. Annual report, January-December 1987.** Haynes, W.M.; Olien, N.A. (National Bureau of Standards, Boulder, CO (USA). Thermophysics Div.). Mar 1988. 62p. NTIS, PC A04/MF A01.

See also PB—88-216809.

Research on the sound speed of natural gas mixtures carried out in the Fluid Properties Group, Thermophysics Division, National Bureau of Standards, Boulder, supported by the Gas Research Institute is reported. The most important results are: sound-speed data for mixtures of natural gas components, including Gulf Coast, Amarillo, Statoil dry gas, and binary mixtures of CO_2 with either CH_4 or N_2 and of CH_4 with C_3H_8 from 250 to 325 K at pressures to 10 MPa and theoretical studies of sound speed modeling using extended corresponding states.

2805 **(PB—88-252911/XAB) Evaluation of data availability and quality for interaction second virial coefficients of use to the gas industry. Technical note (Final).** Van Wie, B.J.; Langenberg, M.A.; Chang, W.C.W.; Kumar, K.H.; Starling, K.E. (National Bureau of Standards (ICST), Washington, DC (USA)). Jul 1988. 108p. (NBS/TN—1249). NTIS, PC A06/MF A01.

Also available from Supt. of Docs. as SN003-003-02881-9.

Binary-interaction second-viral-coefficient information useful to the natural and syngas industries was compiled and evaluated. An extensive literature search was conducted to obtain publicly available information dating back to 1900. Assessments were made to determine data availability and quality and to summarize data needs. No evaluations were made for values resulting from thermo-

dynamic correlations; however, references containing such information are listed. Each binary gas system was individually evaluated and references containing the highest-quality and most-abundant measurements are listed in a table of recommended values.

0340 Combustion

REFER ALSO TO CITATION(S) 3089, 3135

2806 **(GRI—88/0154) Radiation heat transfer in directly-fired natural gas furnaces: A review of literature.** Viskanta, R.; Ramadhyani, S. (Gas Research Inst., Chicago, IL (USA); Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). Jul 1988. 135p. Gas Research Institute, 8600 West Bryn Mawr Avenue, Chicago, Illinois 60631. Order Number TI89001777/JAW.

A critical review of literature of radiation heat transfer in directly fired industrial and metallurgical furnaces has been performed. The review has focused on multidimensional engineering radiative transfer models, experimental data base and validation of the models. The findings have revealed that the experimental work and model validation has been carried out primarily in Europe. Little work appears to have been done in the United States, because it has not been reported in the open literature, owing probably in part to proprietary considerations. Thermal systems models for predicting the thermal performance of furnaces have been also reviewed. It was found that a large number of models have been developed during the past 30 years for predicting heat transfer to the load in natural gas fired combustion systems. However, relatively few of the models have been validated using experimental data. Factors which influence the combustion process itself are discussed. Some schemes for enhancing heat transfer to the load and improving the thermal performance of furnaces are identified. 225 refs., 44 figs., 4 tabs.

2807 **(PB—88-250568/XAB) Development of a rotary valve for pulse-combustion applications. Annual report, June 1986-June 1987.** George, P.E.; Corliss, J.M. (Battelle Columbus Div., OH (USA)). 5 Oct 1987. 55p. NTIS, PC A04/MF A01.

Development of a rotary-valve air inlet for pulse-combustor systems in a variety of industrial applications is reviewed. The work focuses on development of a rotary-valve pulse combustor that will operate at input rates of up to 100,000 Btu/hr with computer control capable of synchronizing a motor-driven valve to combustor pressure oscillations. Activities included integrating the valve and combustor, conducting baseline experiments, developing computer control, integrating components, and performing laboratory evaluation.

0350 Storage

2808 **(PB—88-240924/XAB) Characterization of produced waters from underground natural gas storage reservoir operations. Volume 2. Appendix D. Analytical data report. Topical report, July 1986-June 1988.** Keith, L.H.; Mertens, S.K.; Shore, F.L.; Shepherd, M.C.; Schrynemeeckers, P.J. (ERT, Inc., Pittsburgh, PA (USA)). Jun 1988. 183p. NTIS, PC A09/MF A01.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-88-266-034-07. See also PB—88-173091.

This report presents the results of a nationwide characterization program for produced waters from underground natural gas storage operations. In all, seven produced water samples from seven different sites were collected and analyzed. The analytical methods used and parameters tested in the program paralleled those used in EPA's E&P Waste Study. In general, the produced waters from storage facilities sampled in the program contained volatile organics and, to a lesser degree, selected semivolatile organics. Selected minor and trace elements also were present in the produced water samples. Chloride and total dissolved solids were the most predominant conventional parameters detected. Produced waters did not generally exhibit current RCRA hazardous-waste characteristics. The predominant method used to dispose of these waters is underground injection into Class II wells regulated under the Safe Drinking Water Act.

04 OIL SHALES AND TAR SANDS

0404 Oil Production, Recovery, And Refining

2809 **(DOE/MC/11076—2613) Investigation of the effects of heating rate on coking of shale during retorting.** Guffey, F.D.; Hunter, D.E. (Western Research Inst., Laramie, WY (USA)). Feb 1988. Contract FC21-86MC11076. 17p. NTIS, PC A03/MF A01. Order Number DE88010275/JAW.

The retorting of oil shale distributes organic carbon among three possible products: the liquid product, the noncondensible product, and the residual carbon (coke). The production of coke is detrimental because of the economic effects caused by the loss of organic carbon to this relatively intractable carbon form. Two reference oil shales, a Mahogany zone, Parachute Creek Member, Green River Formation oil shale from Colorado and a Clegg Creek Member, New Albany oil shale from Kentucky, were studied to evaluate the conditions that affect coke production during retorting. The variable that was studied in these experiments was the heating rate during retorting because heating rate has been indicated to have a direct effect on coke production (Burnham and Clarkson 1980). The six heating rates investigated covered the range from 1 to 650{degree}C/h (1.8 to 1169{degree}F/h). The data collected during these experiments were evaluated statistically in order to identify trends. The data for the eastern reference oil shale indicated a decrease in coke formation with increases in the heating rate. The liquid and noncondensible product yields both increased with increasing heating rate. The distribution of products in relation to retort heating rate follows the model suggested by Burnham and Clarkson (1980). Coke production during the retorting of western reference oil shale was found to be constant in relation to heating rate. The liquid product yield increased with increasing heating rate but the trend could not be verified at the 95% confidence level. The coke production observed in these experiments does not follow the prediction of the model. This may indicate that coke formation occurs early in the retorting process and may be limited by the availability of organic materials that form coke. 6 refs., 10 tabs.

2810 **(DOE/METC—88/4080) Flash pyrolysis of Green River shale: Technical note.** Shadle, L.J.; Hobbs, G.R.; Rosencrans, R.D.; Seshadri, K.S.; Jaganathan, J.; Galloway, D.C.; Wang, Y.H.; Shen, M.S.; Lui, A.P.; Grimplin, J.M. (USDOE Morgantown Energy Technology Center, WV). Oct 1987. 41p. NTIS, PC A03/MF A01. Order Number DE88001077/JAW.

This study was part of a multireactor project on rapid shale pyrolysis. The work presented here is a progress report on a major phase of the flash lamp work. A flash lamp reactor was used to study rapid kerogen and shale retorting mechanisms, to evaluate the potential oil yield enhancement due to rapid heating, and to fill in gaps in the data on the composition and distribution of the product from rapid pyrolysis. Two predictive models were developed to evaluate the time-temperature profiles during flash pyrolysis, each with different degrees of complexity and transportability. Experiments were conducted to verify and refine the models in order to obtain better accuracy. Statistically designed flash pyrolysis experiments were conducted in conjunction with model calculations to assess the response of a Green River oil shale under different experimental conditions. 16 refs., 27 figs., 4 tabs.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 2809, 2810

2811 **(DOE/MC/11076—2614) The ^{1}H CRAMPS [combined rotation and multiple-pulse spectrometry] NMR investigation of the organic surface composition and organic mineral interactions of chemically and thermally treated asphalt ridge tar sand: Final topical report.** Netzel, D.A.; Coover, P.T. (Western Research Inst., Laramie, WY (USA)). Apr 1988. Contract FC21-86MC11076. 35p. NTIS, PC A03/MF A01. Order Number DE88010276/JAW.

An exploratory investigation was conducted using the advanced NMR technique CRAMPS (combined rotation and multiple-pulse spectrometry) to provide information on the types of organic functionality via hydrogen types present on the surface of tar sand residues. The solvents hexane, toluene, and methylene chloride were used to extract the bitumen from the native tar sand. All three solvents removed essentially all of the bitumen from the mineral matrix. However, the solid-state ^1H NMR and diffuse reflectance infrared have shown the presence of a small amount of organic material still in contact with the mineral matrix. Tar sand residues after extraction with methylene chloride contain less organic material than the tar sand residues obtained after solvent extraction with hexane. The hydrogen spectra of the residues show a greater amount of aromatic hydrogens than aliphatic hydrogens. Of interest were the relatively large amounts of hydrogen caused by (1) alkyl hydrogens adjacent to ketone carbonyl functionality, (2) hydrogens of methylene groups bridged between aromatic rings, and/or (3) hydrogens of methyl and ethyl substituents on aromatic rings. The infrared data on the extracted tar sand residue also show a relatively large amount of ketone functionality. The spectra of the residues obtained from the isothermal and nonisothermal pyrolysis of the native tar sand show that a relatively large amount of bitumen still remains with the mineral matrix even at a temperature of 380{degree}C (716{degree}F). Above 400{degree}C (752{degree}F) the ^1H spectra changed dramatically but still do not have the ^1H resolution that was apparent in the spectra of the tar sand residues from solvent extraction. The major change in the ^1H spectra of the tar sand residues after pyrolysis above 400{degree}C was the loss of paraffinic hydrogens. 75 refs., 10 figs., 2 tabs.

05 NUCLEAR FUELS

2812 (NIIAR—4(715)) Development on fast reactor fuel cycle. Tsykanov, V.A.; Skiba, O.V.; Porodnov, P.T.; Maershin, A.A.; Sokolovskij, Yu.S.; Kirillovich, A.P.; Makarov, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1987. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704886/JAW.

Briefly described are the results on investigations and technological exploitation of the main components for the fast reactor closed fuel cycle obtained at the V.I.Lenin Research Institute of Atomic Reactors over 1981-1985. Presented are the data on the gas-fluoride processing of irradiated fuel, the electrochemical granulation of the uranium-plutonium oxide fuel as well as on fabrication and test in the BOR-60 of the vibropack fuel pins and fuel subassemblies. 8 refs.; 1 tab.

0501 Reserves, Exploration, And Mining

REFER ALSO TO CITATION(S) 3261, 3578

2813 (PER—155) Metasomatized granulites of the Mozambique belt: consequences for lithospheric U, Th, REE fertilisation and metallogenesis in the ancient Gondwanaland supercontinent. Andreoli, M.A.G.; Hart, R.J. (Wits-CSIR Schonland Research centre for Nuclear Science, Witwatersrand University, Johannesburg, (South Africa)). (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). Feb 1988. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704308/JAW.

The 1,0 Ga old Lurio belt extends for ca. 1 000 km from Nsanje (S Malawi) through NE Mozambique to the Indian ocean. Lower crustal levels are locally exposed along its southern tectonic front. In this article mineralogical and geochemical data for an andesinite-mafic-ultramafic suite from Nsanje were reported.The results indicate that this complex terrane equilibrated first at P {similar←to} 13 kbr and T {similar←to} 900/sup 0/C and subsequently cooled under an eclogite-garnet granulite georem. During a later event (P {similar←to} 7-10 kbar, T {similar←to} 650 - 800/sup 0/C) distinctive metasomatic mica, amphibole, scapolite, apatite, diopsidic pyroxene (MASAD)-bearing assemblages and pegmatoids were formed by CO/sub 2/, Cl, H/sub 2/O, S and F rich fluids with higher REE, U, Th and Zr concentrations than the high-grade precursors. MASAD and older high-pressure granulite parageneses underwent subsequent dehydratation and reequilibration under medium-pressure granulite facies conditions perhaps during the Lurio orogenic event. MASAD-like assemblages are relatively common within the late Proterozoic medium- and high-pressure granulite terranes of Central Gondwana, especially in the newly defined Lurio-Zambezi Eclogite Province. The data provide indicate that the metasomatizing, MASAD-forming fluids had crypto-carbonatitic affinities and were introduced into the crust from the upper mantle during protorifting episodes between ca. 1,1 and 0,5 Ga ago. The MASAD assemblages may therefore represent the crustal equivalent of the metasomatic and MARID suites discovered in mantle xenoliths.

0504 Feed Processing

2814 (DP-MS—88-186) Online fiber optic spectrophotometry. Van Hare, D.R.; O'Rourke, P.E.; Prather, W.S. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 42p. (CONF-881143—1). NTIS, PC A03/MF A01. Order Number DE89002220/JAW.

From American Institute of Chemical Engineers annual convention; Washington, DC, USA (27 Nov 1988).

A fiber optic diode array process analyzer has been developed and installed in a radiochemical separations facility at the Savannah River Plant. The analyzer monitors the uranium and nitrate concentration of seven aqueous process streams in a uranium purification process. The analyzer remotely controls the sampling of each process stream and monitors the relative flow rate through each sampler. Spectrophotometric data from the analyzer is processed by multivariate data analysis to give both uranium and nitrate concentrations as well as an indication of the quality of the data. The analyzer system consists of a DuPont Instruments diode array process analyzer, xenon arc lamp, fiber-optic multiplexer, and IBM industrial AT computer. Fused silica optical fibers (600 micrometer core diameter) connect the analyzer to monitor up to ten locations in series. In addition to the seven process locations, the analyzer also monitors a reference optical fiber and an inline uranyl nitrate standard. Process stream samplers are controlled by Opto 22 hardware and electric solenoid valves interfaced to the analyzer computer through an RS-422 communication link. Absorption data from each location is fed into a Partial Least Squares (PLS) model of the uranyl nitrate system for conversion into uranium and nitrate concentrations. The model also outputs a residual variance which is a very sensitive indicator of interferences in the system and is used to verify the quality of the calculated results. Results from the analyzer computer are sent by another Opto 22 interface to a distributed control system which is used to run the uranium purification process. 8 refs., 22 figs., 1 tab.

0505 Uranium Enrichment

2815 (CONF-8810206—1) Mapping a hierarchical control strategy onto a distributed system architecture. Manges, W.W.; Allgood, G.O.; Thompson, D.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE89001489/JAW.

From International symposium on communications and controls; Baton Rouge, LA, USA (19 Oct 1988).

This paper describes the implementation of the control architecture for the Thermal Management System (TMS) developed for the Atomic Vapor Laser Isotope Separation Program (AVLIS) at the Oak Ridge Gaseous Diffusion Plant in Oak Ridge, Tennessee. It represents one of the major process control subsystems and is responsible for the overall thermal environment during the operational phases of the facility. The author's involvement included the conceptualization, development, design, and implementation of the overall control strategy along with the specification/configuration of the supporting hardware and software. 7 refs., 6 figs.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 3146, 3265, 3482

2816 (DPST—86-477) Throughput limitations and pressure relief of the OSUR [Onsite Uranium Recycle] semiworks off-gas system. Jones, M.K. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 5 Jun 1986. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01. Order Number DE89001646/JAW.

The Robotics and Fabrication Technology Division operates the Onsite Uranium Recycle (OSUR) semiworks to develop equipment for a uranium conversion process. The process converts uranyl nitrate solution to uranium oxide powder by loading the uranium on ion exchange resin and then burning the resin. With proper loading and burning conditions, the uranium oxide ash is suitable for blending with aluminum powder for use in the powder metallurgy fuel tube fabrication process. A production scale OSUR process is currently being designed as a part of the new SRP Fuel Production Facility. The OSUR process will allow SRP to recycle uranium solution directly from the separations area to fuel tube fabrication. The solution is currently trucked to Oak Ridge, Tennessee for the oxide conversion. The resin burning operation consists of feeding uranium-loaded resin into one end of a rotary calciner, and discharging uranium oxide ash at the opposite end. Preheating the resin and then burning it in a near-stoichiometric amount of combustion air gives uranium oxide particles that are (after sintering) dense enough to use in fuel tube fabrication. Off-gases from the combustion process vent through a water scrubber, cyclone separator, and HEPA filter before discharging through a blower to the atmosphere. The calciner typically operates under a slight vacuum (about-4 inches of water). A process hazards analysis of the semiworks generated some concerns regarding the throughput capacity of the ventilation system and the pressure relief capability of the calciner during a process excursion. This document summarizes abnormal conditions that could lead to a process excursion and analyzes their effects on the process ventilation and pressure relief systems.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 2816, 3025, 3259

2817 (AERE-R—12655) Studies on the use of hydroxylamine in fast reactor fuel reprocessing. Miles, J.H.; Healy, T.V.; Wain, A.G.; Cooke, J.; Jeffries, A.; Parrish, F.; Smith, R.; Stewart, R.; Wares, A. (UKAEA Harwell Lab. Chemistry Div.; UKAEA Dounreay Nuclear Power Development Establishment). (UKAEA Harwell Lab. Chemistry Div.). Jul 1987. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754762/JAW.

Unclassified version of PFR/RDSG/P136, (1975).

The paper describes the testing of a complete three cycle flowsheet suitable for use in the reprocessing of fast reactor fuel. The trials were carried out in miniature glass mixer-settler equipment at the Dounreay site. Hydroxylamine was used in the first cycle to effect a 'partial split' - all of the plutonium and about half of the uranium being backwashed into the aqueous phase. In the second cycle hydroxylamine was used to make a complete split, backwashing all of the plutonium but leaving all of the uranium in the organic phase. In the third cycle hydroxylamine was used simply to produce a higher concentration plutonium product than would have been achieved with a simple low acid backwash. Success was achieved in all areas but was particularly clear in cycle 2 where very high decontamination of each product from the other was achieved. Only the third cycle fell short of expectations giving a product about 30g center dot L/sup -1/ plutonium instead of 40g center dot L/sup -1/ as had been anticipated. In order to keep nitric acid concentrations low and hydroxylamine nitrate (HAN) concentrations high. When this was not done high plutonium losses occurred in cycle 2. It was also the reason for the poor performance of cycle 3 where higher nitric acid concentrations arose from those in the organic phase as it reached the backwash contactor.

2818 (CONF-871045—14) Validation studies using joint USDOE/PNC critical experiments. Smolen, G.R.; Whitesides, G.E.; Matsumoto, T.; Funabashi, H. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01. Order Number DE89001873/JAW.

From International seminar on nuclear criticality safety; Tokyo, Japan (19 Oct 1987).

Validation studies have been performed in the United States and Japan using the SCALE-2 computer code system with benchmark data obtained from 46 critical experiments. The experiments spanned the range of neutron spectra from a very undermoderated condition (H/Pu ratio = 22) to a very overmoderated condition (H/Pu ratio = 2220). The experiments are divided into four sets: (1) heterogeneous mixed-oxide fuel pin arrays moderated by organic and aqueous solutions, (2) limiting critical concentration experiments, (3) basic cylinder and slab geometries with various reflection conditions, and (4) annular cylinder with various fixed-geometry poisons. Based on computations performed at the Oak Ridge National Laboratory (ORNL) with the KENO code and a 27 energy-group cross-section library, the average calculated k-effective for the 46 experiments was found to be 1.004. Calculated k-effectives ranged from 0.991 to 1.018, and the standard deviation of these results was 0.006. The Power Reactor and Nuclear Fuel Development Corporation (PNC) staff have obtained similar k-effective results in their validation studies. The good agreement between experiment and calculation gives confidence that the calculation methods and cross-section data can be applied to similar plant conditions. 10 refs., 1 fig., 4 tabs.

2819 (ND-R—1536(D)) Method for the determination of silicon in concentrated plutonium solution. Mair, M.A. (UKAEA Dounreay Nuclear Power Development Establishment). (UKAEA Northern Research Labs., Risley (UK)). Jun 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755486/JAW.

After adjustment of the acidity the sample solution is treated with fluoride to depolymerise the silicon. The fluoride is complexed with boric acid and separated from the plutonium on a cation exchange column. Silicon in the eluate is determined spectrophotometrically as the silicomolybdate complex.

2820 (ORNL-tr—88-35) Process for environmentally safe disposal of the noble gas isotope krypton 85. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1988. Contract AC05-84OR21400. Translated from German Patent DE 3304690 C2, May 11, 1988, 3 pp. 5p. NTIS, PC A02/MF A01. Order Number DE89002481/JAW.

This report describes a process for environmentally safe disposal of the noble gas isotope krypton 85, in which the noble gases krypton and xenon formed in nuclear reactions are separated from one another. A reduction in the Kr-85 release to the atmosphere after fuel reprocessing could be achieved by retention for decay purposes in storage containers or by storage of the fuel elements before reprocessing. Because of the long half time of T/sub 1/2/ = 10.76 yrs, this would require decade-long storage periods. The invention is based on the problem of developing a process by which the isotope krypton 85 formed in nuclear facilities can be disposed of, the radiation exposure to the population diminished, and the expense required for this purpose significantly reduced.

2821 (ORNL/tr—88/23) Kinetic studies of the electrochemical plutonium and hydrazine reduction and oxidation processes in the Purex process for nuclear fuel reprocessing. Heilgeist, M. (Oak Ridge National Lab., TN (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie). Apr 1983. Contract AC05-84OR21400. Translation of Report KfK 3517 (PWA 15/83). 145p. NTIS, PC A07/MF A01. Order Number DE89002484/JAW.

The present study deals with the valence adjustment of plutonium in aqueous nitric acid by electrolytic means. The investigations cover cathodic reduction for the formation of Pu(III) from nitric acid solutions containing Pu(IV) and the stabilizer hydrazine

and also anodic oxidation of hydrazine and Pu(III) for the production of hydrazine-free Pu(IV) solutions. 110 refs., 50 figs., 35 tabs.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 2837, 2861, 2863, 2864, 2865, 2900

2822 **(RFP—4197) Developing nitric acid treatment parameters for passivating reservoir interiors.** Kallas,A.J.; Childs, E.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 7 Sep 1988. Contract AC04-76DP03533. 13p. NTIS, PC A03/MF A01. Order Number DE89002543/JAW.

The Rocky Flats Plant developed a nitric acid treatment (if approved for use), to passivate the interiors of stainless steel reservoirs after subassembly welding. (A reservoir is a container for tritium or deuterium gas). The new passivation equipment will be capable of handling the nitric acid process, if necessary. Test results show that a treatment consisting of 25 vol % reagent-grade nitric acid at room temperature (22--24{degree}C) for 10 minutes forms an adequate passive oxide layer on the stainless steel surface. This relatively low acid concentration forms a more stable, uniform surface oxide than higher concentration (45 vol %) nitric acid. Surface activation (a chemically destructive test) was used to distinquish between the surface oxides formed by the various acid treatments on 304L stainless steel samples. Auger Electron Spectroscopy and X-Ray Photoelectron spectroscopy were used to measure oxide layer composition and thickness on treated 21-6-9 stainless steel samples. Tests were also performed to verify the proper order of the two acid baths in the automated cleaning system for optimum treatment of stainless steel. The tests proved that nitric acid passivates and that Nitradd etches the metal surface. To leave the metal in a passive rather than active condition, the nitric acid bath should follow the Nitradd treatment, which is in reverse order of present practice. 3 refs., 5 figs., 9 tabs.

0520 Waste Management

REFER ALSO TO CITATION(S) 2821, 2898, 3017, 3017, 3052, 3356, 3484, 3576, 3577

2823 **(AD-A—196794/2/XAB) Systems engineering review and design for a small research laboratory low-level radwaste processing system. Final report.** Koppenaal, T.J.; Fabiano, J.A. (Koppenaal and Associates, Mission Viejo, CA (USA)). Jun 1988. 87p. NTIS, PC A05/MF A01.

The U. S. Army Armament, Munitions and Chemical Command (AMCCOM) at Rock Island, Illinois currently administers the radioactive-waste-disposal program for the entire U. S. Army by directing the packaging, transportation and ultimate burial of unwanted radioactive material at commercial waste-disposal requests from any Army element by providing assistance in packaging, shipping, and burial-container certifications. The Safety Office provides detailed instruction to the requesting agency on: how to package the low-level waste, the proper shipping instruction, and how to complete the certification documents for container burial at a commercial site.

2824 **(AERE-R—12868) Small-scale, fully-active vitrification of 'Magnox' and THORP high-level waste.** Dalton, J.C.; Eccles, E.W.; Innes, A.J.; Marples, J.A.C. (UKAEA Harwell Lab. Chemistry Div.). Aug 1987. 21p. (ILWRP—86/P21; DOE-RW—86.053). H.M. Stationery Office, London, price Pound 4.00.

The vitrification of small samples ({similar←to} 30g each) of fully active waste is described. The 'waste' was produced by 'reprocessing' irradiated WAGR fuel and adding the necessary inert components to mimic the high-level wastes arising from the reprocessing of uranium fuel from 'Magnox' reactors and those predicted to arise from the THORP plant. These inert components are principally Al/sub 2/O/sub 3/, MgO and Fe/sub 2/O/sub 3/ for the Magnox waste and Gd/sub 2/O/sub 3/ and Fe/sub 2/O/sub 3/ for THORP waste. Each 'waste' batch was evaporated down with powdered MW precursor glass frit and then melted in an alumina crucible in a furnace. After cooling in the furnace, the glasses were broken out of the alumina crucibles in which they were cast and samples cut for future leach testing. The glasses appeared to be largely vitreous and free of bubbles. The activity level of the glass is about 40 GBq center dot g/sup -1/ ({similar←to}1 Ci center dot g/sup -1/). Radiochemical analysis of small pieces of the glass showed good agreement between the activity levels and those calculated from the analysed isotopic contents of the original aqueous raffinate. As was expected for such small samples, indicated Cs losses were between 10 and 30%.

2825 **(AERE-R—12915) Joule ceramic melter research annual report for 1986/87.** Morris, J.B.; Hollinrake, A.; Ambrose, D.C. and others. (UKAEA Harwell Lab. Chemical Engineering Div.). Jan 1988. 115p. (DOE-RW—88.038). H.M. Stationery Office, London, price Pound 9.00.

Engineering work on the full-scale Joule Ceramic Melter has been suspended owing to a reduction in funding. Work on the Experimental Test Melter has included the measurement of temperature distributions and electrical resistivity on a charge of precursor 241 glass. A new metallic viscometer for measuring viscosity in situ has been tested. Some simplified mathematical models of various conducting sediments have been examined. Batches of the reference glass 241 for present PFR waste have been made by pot vitrification and the rotary calciner/metallic melter routes. Foaming occurred during pot vitrification. Crystalline phases and sediments of RuO/sub 2/ with reduced electrical resistivity were formed. The presence of Na NO/sub 3/ in PFR waste leads to problems during calcination which can be alleviated by adding Al.

2826 **(BMI/ONWI/C—216) Engineering Review Group (ERG) and Geologic Review Group (GRG) report on brine migration at the Deaf Smith County site salt repository horizon.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1986. Contract AC02-87CH10290. 28p. (CONF-8605353—1). H. Order Number TI88016604/JAW.

From Joint Engineering Review Group (ERG) and Geologic Review Group (GRG) meeting on brine migration at the Deaf Smith County site salt repository horizon; Columbus, OH, USA (14 May 1986).

In April 1986, ONWI requested the ERG and GRG to jointly address the status of current knowledge of, and ONWI approach to further characterization of, the geohydrology of the candidate repository horizon of the potential site in Deaf Smith County, Texas. Specifically, the ERG-GRG was asked to evaluate the status of understanding of the hydrogeology of the Lower San Andres Unit 4 (LSA-4) evaporite section and identify any major gaps in the data; evaluate the current understanding of the chemistry and movement of brines in the LSA-4 salt and associated interbeds; develop recommendations for estimating the upper limit quantity of brines, and modeling the brine movement, with respect to the emplaced HLW packages; and identify questions concerning the chemistry of the brines and recommend a technical approach to addressing these questions. 19 refs.

2827 **(BMI/ONWI/C—242) PACCOM: A nuclear waste packaging facility cost model: Draft technical report.** Dippold, D.G.; Tzemos, S.; Smith, D.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). May 1985. Contract AC02-87CH10290. 102p. H. Order Number DE88016461/JAW.

PACCOM is a computerized, parametric model used to estimate the capital, operating, and decommissioning costs of a variety of nuclear waste packaging facility configurations. The model is based upon a modular waste packaging facility concept from which functional components of the overall facility have been identified and their design and costs related to various parameters such as waste type, waste throughput, and the number of operational shifts employed. The model may be used to either estimate the cost of a particular waste packaging facility configuration or to explore the cost tradeoff between plant capital and labor. That is, one may use the model to search for the particular facility sizes and associated cost which when coupled with a particular number of shifts, and thus staffing level, leads to the lowest overall total cost. The functional components which the model considers include hot cells and their supporting facilities, transportation, cask handling facilities,

transuranic waste handling facilities, and administrative facilities such as warehouses, security buildings, maintenance buildings, etc. The cost of each of these functional components is related either directly or indirectly to the various independent design parameters. Staffing by shift is reported into direct and indirect support labor. These staffing levels are in turn related to the waste type, waste throughput, etc. 2 refs., 11 figs., 3 tabs.

2828 **(CEA-R—5457) Contribution to the definition of a medium and low-level activity nuclear waste overcoating material.** (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 184p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755459/JAW.

The containment of solid wastes contaminated by radioactive isotopes can be achieved with an epoxy resin-based composit overcoating. Survey materials have been selected after bibliographic researches. The experimental part consists of the determination of mechanical, physical and chemical properties, radionuclides containing strength and radiation resistance of selected overcoating materials. Finally, it has been proved that using silane coupling agents reduced water and radionuclide diffusion through such materials.

2829 **(CONF-881054—31) A program to establish in situ immobilization as a remedial action option for wastes containing volatile organic compounds (VOC).** Morris, M.I.; Spence, R.D.; Gilliam, T.M.; Dole, L.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89002191/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Sludges and soils containing volatile organic compounds (VOC), base-neutralized acids (BNA), and heavy metals are a generic problem on many military bases due to petroleum fuel-handling activities, metal stripping, fire training, and/or other processing activities. One of the currently acceptable treatment methods for both BNA and heavy metals is immobilization in cement-based grouts, while the only current acceptable treatment method for VOCs is exhumation with incineration. Incineration is an expensive process ($300-600/ton). Therefore, development of a cement-based waste form and an in situ emplacement procedure for the VOC-contaminated sludges and soils is expected to significantly lower the cost ($75-150/ton). This paper describes the program that was developed for the US Air Force (USAF) to establish the technical feasibility and implementation requirements for the in situ immobilization of VOCs in cement-based grouts. Included in this program are: (1) development of procedures and equipment for measuring VOCs; (2) vendor interaction to test current products; (3) preparation of waste forms using vendor formulas on actual site wastes and soils; and (3) performance testing of waste form samples. This paper will also provide the rationale for testing protocols, as well as test results. 1 fig.

2830 **(DOE/CH—13) Response to state comments on the revised draft northeastern regional characterization reports for the Crystalline Repository Project.** (Battelle Memorial Inst., Argonne, IL (USA). Office of Crystalline Repository Development). Aug 1985. Contract AC02-83CH10139. 339p. NTIS, PC A15/MF A01. Order Number DE89002575/JAW.

The purpose of this document is to respond to the comments received from the States of the Northeastern Region on the revised draft Northeastern Regional Characterization Reports (RCRs). The responses in this document indicate the manner in which the suggestions or comments received have been considered in modifying the revised draft Northeastern RCRs. Both general comments related to the overall Crystalline Repository Project (CRP) and comments on specific sections of the RCRs are addressed. This document responds to Northeastern State comments on both the revised draft Northeastern Regional Geologic Characterization Report (RGCR) and the revised draft Northeastern Regional Environmental Characterization Report (RECR).

2831 **(DOE/DP/48025—T2) Sandia National Laboratories Transportation Base Technology Program Plan: [Final report].** (Sandia National Labs., Albuquerque, NM (USA)). 23 Sep 1987. Contract AC01-85DP48025. 70p. NTIS, PC A04/MF A01. Order Number DE89002278/JAW.

This Plan describes the Sandia National Laboratories' Transportation Systems Development Department. The purpose of this plan is to provide a planning document to DOE management that contains a succinct description of current and planned Base Technology activites. The Base Technology Program has six activity areas for developing the technology to solve current and future transportation and packaging problems for the US Department of Energy (DOE) and to provide technical support on institutional and regulatory issues. Funding is provided by DOE's Transportation Management Division within the Office of Defense Programs at DOE Headquarters and coordinated through DOE's Albuquerque Operations Office (AL). These areas include: Testing; Technology Development; Certification Support; and Regulatory Support and Standards Development. 30 figs.

2832 **(DOE/HWP—70) Identification of glass compositions suitable for disposal of waste reactive metal.** Varma, R.; Brown, A.P.; Kumar, R.; San-Pedro, R.; Freeman, C.J.; Helt, J.E. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 37p. (ANL—88-39). NTIS, PC A03/MF A01. Order Number DE89002804/JAW.

This study was conducted in support of a project to convert waste sodium to a form that is amenable to easy disposal in ordinary landfills. This waste sodium will be from reactor and other operations at the US Department of Energy and will contain small amounts of radioactive species that must not be released to the environment in an uncontrolled manner. The sodium will be converted into a glass that will contain and isolate the radionuclides present in it. This study was conducted to define acceptable glass compositions that (1) are resistant to leaching of sodium by groundwater and rainwater, (2) contain a relatively large proportion of sodium so that unreasonably large volumes of the glass for disposal will not be produced, and (3) are conveniently prepared from the waste sodium. For this purpose, glass samples containing varying amounts of the oxides of sodium, calcium, boron, aluminum, and silicon were prepared in the laboratory. The samples were subjected to the accelerated MCC-1 test to determine resistance to leaching by water at 60{degree}C. Soda-silica glasses were observed to dissolve in the water rather quickly. Addition of the other ingredients was found to impart significant leach resistance to the glasses. Among the high-Na_2O glasses, those containing alumina (3% Al_2O_3-10% CaO-30% Na_2O and 6% Al_2O_3-10% B_2O_3-30% Na_2O) were found to be most resistant to leaching. Lowering the Na_2O content to 20% made these glasses even more leach resistant. 8 refs., 6 figs., 2 tabs.

2833 **(DOE/JIO—023) Long-range master plan for Defense Transuranic Waste Management.** (USDOE Joint Integration Office, Albuquerque, NM; Rockwell International Corp., Albuquerque, NM (USA). Joint Integration Office; Westinghouse Electric Corp., Carlsbad, NM (USA)). Jul 1987. Contract AC04-86AL31950. 83p. NTIS, PC A05. Order Number DE89002713/JAW.

It is the responsibility of the Department of Energy (DOE) to plan, develop, and implement long-term transuranic (TRU) waste management capabilities. TRU waste management capabilities ensuring safe and permanent isolation must be technically and economically effective and feasible, and represent acceptable solutions to institutional requirements and policy issues. Due to the toxicity and long half- life of TRU isotopes, deep geologic emplacement is the favored method of isolating retrievably stored and newly-generated defense TRU wastes. This deep geologic emplacement will occur in New Mexico at the Waste Isolation Pilot Plant (WIPP). Until WIPP is operational, management of these wastes will continue to be performed in a safe and responsible manner at the various DOE Waste Management sites. The Long Range Master Plan for Defense Transuranic Waste Management, or "Master Plan," defines current plans for the permanent disposal of TRU waste and serves as a framework for the Defense Transuranic

Waste Program (DTWP) in the transition period from interim management to permanent disposal. 27 refs., 17 figs., 11 tabs.

2834 **(DOE/NE—0094) 1987 annual report on low-level radioactive waste management progress: Report to Congress in response to Public Law 99-240.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC). Aug 1988. 101p. NTIS, PC A06/MF A01. Order Number DE89002809/JAW.

In response to Section 7(b) of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240), this report summarizes the progress of states and low-level radioactive waste compacts in 1987 in establishing new low-level waste disposal facilities. It also reports the volume of low-level waste received for disposal in 1987 by commercially operated low-level waste disposal facilities.

2835 **(DOE/OR/21548—038) Electrical power line and pole removal radiological survey completion report: Weldon Spring Site Remedial Action Project: Revision 0.** (MK-Ferguson Co., Weldon Spring, MO (USA)). [1988]. Contract AC05-86OR21548. 81p. NTIS, PC A05. Order Number DE89002422/JAW.

The following radiological survey completion report was prepared as an overview of the radiological measurements performed for the now completed work package WP018, Electrical Power Line and Pole Removal. Because of the dangers presented by the deteriorating state of the power poles an interim remedial action was initiated. The purpose of this report is to summarize the plan for the radiological survey of the power poles and lines and to document the amount of material released from the Weldon Spring Site for unrestricted use.

2836 **(DOE-RW—87.101) Research requirements related to radioactivity in the environment.** Fry, F.A.; Hill, M.D.; Wilkins, B.; Cooper, J.R. (National Radiological Protection Board, Chilton (UK)). (Department of the Environment, London (UK)). May 1988. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755538/JAW.

A set of papers identifying perceived national research requirements to 1989 had been prepared by various organisations for the Radioactivity, Research and Environmental Monitoring Committee. The Committee had also received a set of papers describing the research to be carried out or commissioned by Government Departments, advisory bodies and the nuclear industry in 1987-9. The purpose of the present report in the general area of radioactivity in the environment is to consider those papers and identify any gaps or overlaps in the national research effort to 1989. Five gaps are identified and their significance is commented upon.

2837 **(DOE-RW—87.125) Magnox fuel dry storage and direct disposal assessment of CEGB/SSEB reports.** (Department of the Environment, London (UK); Ove Arup and Partners, London (UK)). Dec 1987. 64p. (OAP-IE—87.178). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754764/JAW.

This report assesses the Boards' presented work in response to Recommendations 17 and 18 of the Environment Committee's First Report (Jan 86). The Boards have made an extensive study of the dry store design and also considered direct disposal. Their basic conclusion that the financial advantage is with continued reprocessing is accepted with the comment that their storage and disposal costs may be on the high side. The Boards statements on drying wet-stored fuel and on improvement of the fuel's chemical stability are accepted. The Boards coverage of fuel after disposal is considered to be too brief; the assessment expresses a more pessimistic view than the Boards' of the acceptability of direct disposal.

2838 **(DOE-RW—88.016) Magnetite precipitation and characterisation.** Joyce, A.; Garside, J.; Ivens, R. (ed.). (Manchester Univ. (UK). Inst. of Science and Technology; British Nuclear Fuels Ltd., Sellafield). (Department of the Environment, London (UK)). Jun 1988. 24p. (PCMRP—86-P19). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755539/JAW.

Magnetite (Fe/sub 3/O/sub 4/) precipitation was investigated as a possible alternative treatment process to the conventional ferric hydroxide for removal of actinides from radioactive effluents. This offered the possibility of improved dewatering of filtered residues. Whilst a poor quality magnetite could be produced from deoxygenated ferrous/ferric solutions, all attempts to prepare magnetite from effluent simulates were unsuccessful. The failure was attributed to the presence of high nitrate and other interfering ions.

2839 **(DOE-RW—88.017) Use of magnetite for decontaminating alpha containing effluents.** Ivens, R. (British Nuclear Fuels Ltd., Sellafield). (Department of the Environment, London (UK)). Jun 1988. 11p. (PCMRP—85-P14). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755540/JAW.

The feasibility of retention of precipitated magnetite by magnetic filtration followed by direct cementation offered an attractive alternative to conventional ferric hydroxide treatment of radioactive liquid effluents. The magnetically-assisted dewatering of laboratory-prepared magnetite was examined in a number of ways, none of which achieved the desired optimum solids content for cementation. Attempts to prepare magnetite in situ from typical effluents containing iron were unsuccessful owing to the presence of interfering ions. Preformed magnetite was reasonably effective at absorbing actinides from solution but did not appear to offer any significant advantage over ferric hydroxide.

2840 **(DOE-RW—88.057) Sensitivity analysis for near-surface disposal in argillaceous media using NAMMU-HYROCOIN Level 3-Test case 1.** Miller, D.R.; Paige, R.W. (Atkins (W.S.) and Partners, Epsom (UK)). (Department of the Environment, London (UK)). Jul 1988. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755545/JAW.

HYDROCOIN is an international project for comparing groundwater flow models and modelling strategies. Level 3 of the project concerns the application of groundwater flow models to repository performance assessment with emphasis on the treatment of sensitivity and uncertainty in models and data. Level 3, test case 1 concerns sensitivity analysis of the groundwater flow around a radioactive waste repository situated in a near surface argillaceous formation. Work on this test case has been carried out by Harwell and will be reported in full in the near future. This report presents the results obtained using the computer program NAMMU.

2841 **(DOE/WIPP—86-007) Waste Isolation Pilot Plant (WIPP) Contract Work Breakdown Structure (CWBS) dictionary.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). 16 Jul 1986. Contract AC04-86AL31950. 267p. NTIS, PC A12/MF A01. Order Number DE89002783/JAW.

This document contains work orders for contract work at the WIPP site. (TEM)

2842 **(DOE/WIPP—87-009) Report of the remote-handled transuranic waste mock retrieval demonstration.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). May 1987. Contract AC04-86AL31950. 6p. NTIS, PC A02/MF A01. Order Number DE89002778/JAW.

This report documents the results of the mock, onsite retrieval demonstration that was conducted on May 19 and 20, 1987, for representatives of the New Mexico Environmental Evaluation Group (EEG). Demonstration of the retrievability of remote-handled transuranic (RH TRU) waste is part of a milestone included in the Agreement for Consultation and Cooperation between the state of New Mexico and the United States Department of Energy. Retrieval equipment design documents and a retrievability demonstration plan for RH TRU waste were previously transmitted to the EEG. This report documents the results of the demonstration by evaluating the demonstration against the acceptance criteria that were established in the Demonstration Plan. 1 fig., 2 tabs.

2843 **(DOE/WIPP—87-011) Preoperational checkout of the remote-handled transuranic waste handling at the Waste Isolation Pilot Plant.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Sep 1987. Contract AC04-86AL31950. 58p. NTIS, PC A04/MF A01. Order Number DE89002774/JAW.

This plan describes the preoperational checkout for handling Remote-Handled Transuranic (RH-TRU) Wastes from their receipt at the Waste Isolation Pilot Plant (WIPP) to their emplacement underground. This plan identifies the handling operations to be performed, personnel groups responsible for executing these operations, and required equipment items. In addition, this plan describes the quality assurance that will be exercised throughout the checkout, and finally, it establishes criteria by which to measure the success of the checkout. 7 refs., 5 figs.

2844 **(DOE/WIPP—87-014) Assessment of allowable transuranic activity levels for WIPP wastes.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Dec 1987. Contract AC04-86AL31950. 33p. NTIS, PC A03/MF A01. Order Number DE89002780/JAW.

This study provides a technical evaluation for the establishment of an upper limit on the transuranic content of waste packages to be received. To accomplish this, the predicted radiological performance of WIPP is compared to the radiological performance requirements applicable to WIPP. These performance requirements include radiation protection standards for both routine facility operations and credible operational accidents. These requirements are discussed in Chapter 2.0. From the margin between predicted performance and the performance requirements, the maximum allowable transuranic content of waste packages can then be inferred. Within the resulting compliance envelope, a waste acceptance criterion can be established that delineates the allowable level of transuranic radioactivity content for contact handled (CH) and remote handled (RH) waste packages. 13 refs., 8 tabs.

2845 **(DOE/WIPP—88-001) Defense remote-handled transuranic waste implementation plan: Transuranic Waste Program System Integration Office.** Stumbaugh, J.E.; Pierce, G.D.; Carson, P.H. (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Jan 1988. Contract AC04-86AL31950. 27p. NTIS, PC A03/MF A01. Order Number DE89002777/JAW.

This document presents a detailed schedule for the implementation of the strategy for managing defense remote-handled (RH) transuranic (TRU) waste. The baseline management strategy was defined in the Defense Remote-Handled Transuranic Waste Cost/Schedule Optimization Study and is summarized in this document. Also included are revised RH TRU waste inventory projections, current site management plans, a list of key decision points and milestones, and a discussion of uncertainties associated with management of RH TRU waste. The plans are summarized in a detailed schedule diagram and in an RH TRU waste work off diagram. 9 refs., 5 figs., 4 tabs.

2846 **(DOE/WIPP—88-003) Waste Isolation Pilot Plant CH TRU preoperational checkout plan.** (Westinghouse Electric Corp., Carlsbad, NM (USA)). 10 Feb 1988. Contract AC04-86AL31950. 11p. NTIS, PC A03/MF A01. Order Number DE89002771/JAW.

The Waste Isolation Pilot Plant (WIPP) is a major system acquisition authorized as a research and development facility to demonstrate safe disposal of both remote handled (RH) and contact handled (CH) transuranic defense waste in bedded salt. In addition to these full-scale demonstrations, WIPP will provide facilities for experimentation with radioactive materials. This plan documents the scope for the contact handled (CH) transuranic (TRU) waste handling systems preoperational checkout at WIPP. Results from the CH TRU preoperational checkout establish the basis for a preoperations checkout report to be used for WIPP operational readiness review activities. The report will be provided to the State of New Mexico, prior to WIPP waste receipt, and will satisfy, in part, the Agreement for Consultation and Cooperation between the US Department of Energy (DOE) and the State of New Mexico. The objective of the preoperational checkout is to demonstrate that CH TRU waste can be received at WIPP, transported underground (U/G) and emplaced in the U/G repository safely while meeting WIPP Quality Assurance requirements. 6 refs., 6 figs., 10 tabs.

2847 **(DOE/WIPP—88-006) Contact-handled transuranic waste mock retrieval demonstration: Final report.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). 28 Jan 1988. Contract AC04-86AL31950. 66p. NTIS, PC A04/MF A01. Order Number DE89002763/JAW.

This report documents the results of the Contact-Handled Transuranic (CH TRU) Waste Mock Retrieval Demonstration which was conducted at the Waste Isolation Pilot Plant (WIPP). Successful completion of the demonstration using mock (non-radioactive) waste packages is a prerequisite to the receipt of actual CH TRU waste. The demonstration was witnessed by members of the Environmental Evaluation Group (EEG) of the State of New Mexico. The demonstration was completed in Room 1 of Panel 1 of the WIPP underground storage area. This area was configured to simulate in-situ storage conditions projected to be encountered late in the retrieval period. The retrieval period extends for 10 years beyond the Operations Demonstration period which is up to five years in duration. At the conclusion of the Operations Demonstration, a declaration would be made regarding whether or not WIPP should become a permanent TRU disposal facility. Even though salt creep in the storage area is not projected to contact the waste stack, as a worst-case scenario, the demonstration included retrieval techniques which would be employed should stack contamination be encountered. A Contamination Control Barrier was installed upstream of the demonstration waste stack. This barrier incorporated a pass-through system which was used to overpack simulated contaminated waste package. The demonstration confirmed the acceptability of WIPP operational procedures, personnel, equipment, and techniques. Further, extrapolation of the operating time line data developed during this demonstration has confirmed that in-room retrieval of up to 930,000 ft^3 of CH TRU waste can be completed within applicable radiological and time constraints. 6 refs., 10 figs., 2 tabs.

2848 **(DOE/WIPP—88-009) Annual site environmental monitoring report for the Waste Isolation Pilot Plant: Calendar year 1987.** Flynn, D.T. (ed.). (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). May 1988. Contract AC04-86AL31950. 89p. NTIS, PC A05/MF A01. Order Number DE89002781/JAW.

This is the third annual preoperational Site Environmental Report for the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The purpose of WIPP is to provide a research and development facility to demonstrate the safe disposal of transuranic (TRU) wastes generated by the defense activities of the US government. The report provides a comprehensive description of environmental activities at WIPP during calendar year 1987, including (1) a description of the WIPP project and its mission; (2) a description of the local environment, including demographics; (3) a summary of environmental program information, including an update on the status of environmental permits and compliance activities; (4) a presentation of the data of the Radiological Baseline Program (RBP), which is a program to characterize background radionuclide concentrations in the environment around the WIPP site; and (5) a summary of findings of the Ecological Monitoring Program (EMP), which examines nonradiological impacts of WIPP construction on the surrounding ecosystem. This report reflects the data received at the time of publication. Complete analytical results will be reported in a comprehensive data compilation for the RBP. 33 refs., 26 figs., 24 tabs.

2849 **(DOE/WIPP—88-012) Waste Isolation Pilot Plant contact-handled transuranic waste preoperational checkout: Final report.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Jul 1988. Contract AC04-86AL31950. 85p. NTIS, PC A05. Order Number DE89002765/JAW.

This report documents the results of the WIPP CH TRU Preoperational Checkout which was completed between June 8 and June 14, 1988 during which period, a total of 10 TRUPACT shipping containers were processed from site receipt through emplace-

ment of the simulated waste packages in the underground storage area. Since the design of WIPP includes provisions to unload an internally contaminated TRUPACT, in the controlled environment of the Overpack and Repair Room, one TRUPACT was partially processed through this sequence of operations to verify this portion of the waste handling process as part of the checkout. The successful completion of the CH TRU Preoperational Checkout confirmed the acceptability of WIPP operating procedures, personnel, equipment, and techniques. Extrapolation of time-line data using a computer simulation model of the waste handling process has confirmed that WIPP operations can achieve the design throughput capability of 500,000 ft^3/year, if required, using two waste handling shifts. The single shift throughput capability of 273,000 ft^3/year exceeds the anticipated operating receival rate of about 230,000 ft^3/year. At the 230,000 ft^3/year rate, the combined CH TRU annual operator dose and the average individual dose (based on minimum crew size) is projected to be 13.7 rem and 0.7 rem, respectively. 6 refs., 27 figs., 3 tabs.

2850 **(DOE/WIPP—88-014) Criticality safety analysis for contact handled waste at the Waste Isolation Pilot Plant.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Jun 1988. Contract AC04-86AL31950. 54p. NTIS, PC A04/MF A01. Order Number DE89002775/JAW.

The Waste Isolation Pilot Plant (WIPP) is a facility designed to store transuranic (TRU) waste underground in a mined salt bed. All fissile nuclides except U^{235} are considered TRU nuclides. The waste material will be contained in 55 gallon steel drums and steel boxes. In general the fissile waste material is mainly surface contamination on clothing, wipes, wrappings, tools, etc., or mixed in evaporator heels and resins. Other fissile material may be contained in absorbent mixtures. As a result, the fissile material will typically be spread over a large fraction of the volume in most storage drums and boxes. Typical isotopic content of the fissile material is shown. This analysis will analyze the waste storage configurations at the WIPP site to show that up to 200 grams of fissile material per box can be stored at the site. 5 refs., 26 figs., 5 tabs.

2851 **(DOE/WIPP—88-020) Criticality safety analysis for remote handled TRU waste at the Waste Isolation Pilot Plant.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Jul 1988. Contract AC04-86AL31950. 33p. NTIS, PC A03/MF A01. Order Number DE89002768/JAW.

The Waste Isolation Pilot Plant (WIPP) is a facility designed to store transuranic (TRU) waste underground in a mined salt bed. All fissile nuclides except U^{235} are considered TRU nuclides. This report presents the results of the nuclear criticality analysis for Remote-Handled (RH) TRU waste stored at the WIPP site. The RH waste material will be contained in steel canisters that are five feet or ten feet long. Each ten foot canister is capable of holding three 55 gallon drums of waste material. The five foot canisters are to be welded together to form one ten foot long canister. In general the fissile waste material is mainly surface contamination on clothing, wipes, wrappings, tools, etc., or mixed in a borosilicate glass matrix or concrete. Other fissile material may be contained in absorbent mixtures. As a result, the fissile material will typically be spread over a large fraction of the volume in most of the waste storage canisters. Typical isotopic content of the fissile/other radioactive material is shown in Table 1-1. This analysis will analyze the RH waste storage and handling configurations at the WIPP site to show that up to 600 grams of fissile material per ten foot canister can be received and stored at the site without criticality safety concerns. 6 refs., 14 figs., 1 tab.

2852 **(DP-MS—88-157) Some special considerations in evaluating the impacts of long-lived radionuclides in LLW.** Cohen, J.J.; Smith, C.F.; Cook, J.R.; King, C.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1988. Contract AC09-76SR00001. 16p. (CONF-880839—9). NTIS, PC A03/MF A01. Order Number DE89002888/JAW.

From Annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

The objective of the current study is to characterize issues related to long-lived radionuclides in SRP waste. This work includes defining a reasonably attainable data base on parameters affecting leachability, mobility, dosimetry, and other factors that might affect radiological dose consequences. the long-lived radionuclides to be assessed include: certain transurancies, uranium, technetium-99, iodine-129, and carbon-14. The study is scheduled for completion by the end of this year. Preliminary insights and conclusions focusing primarily on neptunium-237, iodine-129, and uranium are discussed in this paper. 28 refs., 1 fig., 6 tabs.

2853 **(DPST—86-389) Phosphate additions to borosilicate waste glass cause phase separation.** Jantzen, C.M. (Savannah River Lab., Aiken, SC (USA)). 15 Apr 1986. Contract AC09-76SR00001. 9p. NTIS, PC A02/MF A01. Order Number DE89002451/JAW.

The tolerance of borosilicate glass to phosphate addition was examined to assess the following: The effects of substituting H_3PO_4 or H_3PO_2 for formic acid in the Slurry Receipt Adjustment Tank (SRAT) in order to lower the reducing capacity of the slurry feed stream; the effects of higher than predicted concentrations of P_2O_5 in waste feed streams to the Defense Waste Processing Facility; and the effects of adding phosphate compounds as potential melt flux or catalysts. Experimental results demonstrated that the effective solubility of phosphate as (PO_4)/sup {minus}3/ in 165 waste glass is 3 wt %. At phosphate levels of ≧4 wt % (PO_4)/sup {minus}3/ phase separtion of Li_3PO_4 occurs in as-fabricated glasses. Use of phosphorous compounds as slurry reductants, catalysts or fluxes is, therefore, not recommended. 8 refs., 3 figs.

2854 **(DPST—86-859) DWPF corrosion study.** Selby, C.L. (Savannah River Lab., Aiken, SC (USA)). 17 Dec 1986. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01. Order Number DE89002446/JAW.

Corrosion of candidate alloys for the DWPF SRAT, SME, and melter was tested in the large (1/3 scale) SRAT/SME, the 200th scale SRAT/SME, and the LSFM. Flat or twisted coupons with or without a weld bead and U-bend specimens (specimens bent into a "U" shape and bolted together at the ends to stress the bend area) were installed on racks that ensured electrical isolation to avoid galvanic effects. Teflon{reg←sign} washers isolated the low temperature exposure racks and ceramic washers isolated the high temperature exposure racks. Serrated washers simulated crevices, but crevice corrosion did not result. 9 refs., 9 tabs.

2855 **(EUR—11089) Community's research and development programme on radioactive waste management and storage Shared cost action. Annual progress report 1986.** Orlowski, S.; Gandolfo, J.M. (Commission of the European Communities, Brussels (Belgium)). (Commission of the European Communities, Luxembourg). 1988. 385p. NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755642/JAW.

This is the first annual progress report of the European Community's 1985-89 programme of research on radioactive waste management and disposal, carried out by public organizations and private firms in the Community under cost-sharing contracts with the Commission of the European Communities. The 1985-89 programme is aiming at perfecting and demonstrating a system for managing the radioactive waste produced by the nuclear industry, ensuring at the various stages the best possible protection of man and the environment. This first report describes the work to be carried out under the research contracts already concluded before end of 1986 as well as the initial work performed and the first results obtained. For each contract, paragraph C "Progress of work and obtained results" was prepared by the contractor under the responsibility of the project leader.

2856 **(EUR—11097) Study of cesium trapping mechanism by cement-additive mixtures for nitrate waste embedment.** Bouniol, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). (Commission of the European Communities, Luxembourg). 1987. 49p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755643/JAW.

This final report is devoted to the selection of additive-cement mixtures which could be used for cesium retention in the

case of 300 g/l sodium nitrate waste embedment. Different types of additive are tested, mainly sodium and calcium smectites, TUBAC pozzolan, silica fume and calcium hexacyanoferrate, together with the three principal cements known in France: Portland cement, Pozzolanic (CLC) and high Alumina cement. Adsorption-desorption capacities of these different additive-cement mixtures with and without sodium nitrate are evaluated. Three solutions are considered to improve cesium retention in the case of sodium nitrate embedment: (1) hexacyanoferrate with Alumina cement (precipitation of (Ca, Cs) ferrocyanide, insoluble at high pH), (2) sodium smectite with silica fume and CLC, (3) sodium smectite wiht silica fume and Portland cement. These two last additives are complementary: Na-smectite exchanges sodium with cesium at the early stages of mixture and silica fume fills up intergranular spaces and decreases the pH of the interstitial pore water.

2857 **(EUR—11188) Study of the propagation of dislocation in argillaceous materials and side effects.** ENEA, Casaccia; Centro Ricerche Energia. (IT). (Commission of the European Communities, Luxembourg). 1987. 212p. (In Italian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755462/JAW.

As part of the research programme on radioactive waste disposal, the numerical modelling of the propagation of shear bands in the plastic clays is studied more directly and some numerical results have been obtained. In particular the connection between clay constitutive laws and bifurcation criterion is studied to know the dislocation value at which the propagation of shear bands may take place. The experimental program, connected with numerical modelling of fracture propagation in clay due to a displacement in the basement, covered the following two aspects: - investigation of the response of clays under high pressure; - development of a prototype of a plane strain shear box with a movable base. Tests to investigate the response of argillaceous materials under high pressure have been undertaken to prove the validity in this stress range of the assumptions of the constitutive model developed. The second aspect of the experimental program was aimed at a preliminary investigation of a discontinuity in clay. Finally, in the situ observations about fracture propagation in clay have led to preliminary conclusion that at least near the surface, the blue clays of plio-pleistocenic age are always intersected by a network of fissures. Within a few tens of meters from the surface some of the fissures can show oxidated bands of thickness up to two or three centimeters which is due to contact with percolating water and/or air. Informations about fracturing and clay behaviour at greater depth have been obtained from people involved in tunneling works. In conclusion it appears that the fracture response and the secondary permeability of clay masses are characterized by a wide variability, due to many factors at play.

2858 **(EUR—11230) Immobilization of tritiated wastewater by hydraulic cements. A survey of the state-of-the-art.** Mannone, F. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1987. 65p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755645/JAW.

An experimental research programme including as one of its major items the definition of a strategy for tritiated waste management is being prepared at the JRC-Ispra. Laboratory work will be performed in ETHEL, the European Tritium Handling Experimental Laboratory under construction at Ispra. To provide background information needed for defining items and planning the execution of such activities, a survey of the state of the art and R and D performed in the field of tritiated water immobilization by hydraulic cements and ultimate packaging by multiple containment systems has been carried out. Particular attention has been focused on results of tritium leach test programmes performed at various USA laboratories in order to verify the leach resistance properties of some tritium immobilization and containment options. Problems and draw backs associated with such options are discussed. Final conclusions are presented. 49 refs.

2859 **(EUR—11253) Immobilization of krypton in a metal matrix.** Whitmell, D.S. (UKAEA Harwell Lab. Materials Development Div.). (Commission of the European Communities, Luxembourg). 1987. 97p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755648/JAW.

The report presents the work carried out on the immobilization of krypton in a metallic matrix by combined ion implantation and sputtering. The process has been successfully tested using 100 curies of fully active krypton in order to demonstrate that the process operates in the radiation levels which will be obtained with active gas at a reprocessing plant. A design study for a plant for fuel reprocessing has shown that the process can be simply operated, without requiring shielded cells. These results, which complete the development programme, indicate that the process is ideal for the containment of kripton arising from the processing of nuclear fuel and that the product will retain the gas under normal storage conditions and also during simulated accident conditions.

2860 **(EUR—11321) Geochemical and microbiological studies on the sand-clay series of Orte.** Brondi, A. (ENEA, Rome (IT)). (Commission of the European Communities, Luxembourg). 1988. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755649/JAW.

The geochemical characteristics of the host rocks play a major role with regard to the mobility of radionuclides contained in wastes disposal in geological formations. Redox conditions in particular may control the potential migration of radionuclides within the geosphere. Geological and geochemical investigations were conducted in a quarry in the Tiber Valley, near Orte, with the aim of understanding the geochemical variations as well as their evolutive trend of local clay at the oxido-reduction front. The upper part of the local plio-pleistocenic series is made up of clay banks interbedded with sandy levels. Clay is dominant in the lower part of the series; sand constitutes on the contrary the final cover of the sequence. The different colors shown by the two different lithological components, grey for clay and yellow for sand, probably reflects a different geochemical condition, reduction for the grey, oxidation for the yellow one. Both clay and sand components were presumably originally characterized by reducing conditions; they were therefore grey colored. The preferential permeation of meteoric water within the permeable sands is at the origin of the oxidation of this component, once the whole series had been uplifted in the continental environment yellow color is a record of this event. The original geochemical content of U, Th and V of the clayey levels appear to be unaffected by the strong oxidizing environment of surficial water. This fact testifies the substantial impermeability of clay as well its capacity of maintaining the original reducing characters which should prevent the transuranic radionuclides of waste to be mobilized. Bacteria have been demonstrated to be at a latent state of life within clay. They may contribute in maintaining the original reducing character of clay.

2861 **(INIS-GB—154) CEGB/SSEB response to Recommendations 17 and 18 in the Environment Committee's Report on Radioactive Waste. An overview.** (Central Electricity Generating Board, London (UK); South of Scotland Electricity Board, Glasgow (UK)). Dec 1986. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754767/JAW.

This paper and its accompanying reports respond to recommendation 17 and 18 in the report of the Environment Committee on "Radioactive Waste" published in 1986. These recommendations are: "Recommendation 17: The CEGB and SSEB should conduct a full and published analysis of: (1) the cost of backfitting dry stores to Magnox stations, comparing these costs with the costs of reprocessing vitrification and storage of vitrified high level waste (VHLW); (ii) the feasibility of drying-off Magnox spent fuel once it has been wet in a cooling pond. Recommendation 18: The Department of the Environment should commission and publish a study of the characteristics of Magnox spent fuel in final disposal and of any possible methods of dealing with the particular problems of the long-term chemical instability of uranium metal." A feasibility study into the dry storage of Magnox fuel (Rec. 17) and a technical appraisal of the scope for direct disposal (Rec. 18) are included.

2862 **(INIS-GB—155) CEGB/SSEB response to Recommendation 18 in the Environment Committee's Report on Radioactive Waste. Analysis of options in the processing and disposal of spent Magnox fuel.** (Central Electricity Generating Board, London (UK); South of Scotland Electricity Board, Glasgow (UK)). Dec 1986. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754768/JAW.

This report assesses the potential for the direct disposal of Magnox fuel which has previously been stored under dry conditions. It examines what, if any, processing the fuel may require prior to encapsulation, how encapsulation should be performed, the applicability of the existing multi-barrier concept for the disposal of spent oxide fuel and other relevant wastes, and whether the objectives for safe disposal can be attained.

2863 **(INIS-GB—156) CEGB/SSEB response to Recommendation 17 in the Environment Committee's Report on Radioactive Waste. V.1. Executive summary and main report.** (Central Electricity Generating Board, London (UK); South of Scotland Electricity Board, Glasgow (UK)). Nov 1986. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754769/JAW.

The first report from the Environment Committee concerning radioactive waste was published on 12th March 1986. Recommendation 17 of the Committee's report asked the CEGB and SSEB (the Home Boards) to carry out and publish an analysis of the costs of backfitting dry stores to Magnox stations and compare this with the costs of reprocessing, vitrification and subsequent storage of vitrified HLW. In addition the Committee asked that the Home Boards should examine the feasibility of drying Magnox spent fuel once it had been wet in the cooling ponds. This report represents the Home Boards' response to Recommendation 17. In addition, in order to provide a comprehensive economic comparison, consideration has also been given to the likely range of costs for treatment and final disposal of Magnox spent fuel. In carrying out this study the Home Boards have assessed the technical feasibility, costs and likely timescales associated with establishing new all-dry discharge routes on each of the individual Magnox stations and constructing dry storage facilities suitable for storing Magnox fuel for up to 100 years.

2864 **(INIS-GB—157) CEGB/SSEB response to Recommendation 17 in the Environment Committee's Report on Radioactive Waste. V.2. Appendices.** (Central Electricity Generating Board, London (UK); South of Scotland Electricity Board, Glasgow (UK)). Nov 1986. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754770/JAW.

Assuming a government policy decision or a joint CEGB/SSEB decision to store rather than reprocess Magnox spent fuels alternative programmes for planning for the dry storage of spent fuels at each Magnox station or a central site are considered. The importance of the time required to obtain planning permission is emphasised. (U.K.).

2865 **(INIS-GB—158) Dry storage of Magnox fuel. Report of Joint NNC/GEC-ESL studies commissioned by Central Electricity Generating Board.** (Central Electricity Generating Board, London (UK); National Nuclear Corp. Ltd., Risley (UK)). Sep 1986. 111p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754771/JAW.

This work, commissioned by the CEGB, studies the feasibility of a combination of short-term pond storage and long-term dry storage of Magnox spent fuel as a cheaper alternative to reprocessing. Storage would be either at the reactor site or a central site. Two designs are considered, based on existing design work done by GEC-ESL and NNC; the capsule design developed by NNC and with storage in passive vaults for up to 100 yrs and the GEC-ESL tube design developed at Wylfa for the interim storage of LWR. For the long-term storage of Magnox spent fuel the GEC-ESL tubed vault all-dry storage method is recommended and specifications for this method are given. (U.K.).

2866 **(INIS-mf—11827) Progress and efficiency on SFR. Work study from a rock excavation project.** Li Shisen. (Swedish State Power Board, Vaellingby). [1985]. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755426/JAW.

The study comprehends an analysis of construction management at the work site of SFR, the final repository for low and medium level nuclear waste, situated in Forsmark. The period of analysis is 1985. During this year, the most intensive part of the rock excavation work of totaly 430,000 solid cubic metres took place. Many tunnels and big chambers as well as a huge silo were driven. Many drawings and figures are given to show how the project was going on and how the construction efficiency was during the year of 1985. SFR is a highly mechanized underground project. Based on the analysis of the composition of the construction costs in SFR, the work study points out that the machine costs is the biggest part in the construction costs, and that there is a close relation between the construction costs and machine management. Some experience in reducing construction costs and some experience in construction management are introduced in detail. In order to improve the machine management, attention should be paid to increase the utilization ratio of machines. A preliminary study of time utilization ratio of drill jumbo and bolting rig is given.

2867 **(KFK—4406) Equilibrium concept - a new approach to the long-term assessment of radionuclide release from a radioactive waste repository.** Koester, R.; Rudolph, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). Aug 1988. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755587/JAW.

In long-term safety considerations for a radioactive waste repository the accident of a water ingression into the storage sites plays a prominent part. The release rate of radionuclides in this event is frequently assessed using a source term. Some typical equations derived for this purpose under various boundary conditions are presented. They consider diffusion and congruent matrix dissolution as the rate-determining release mechanisms. As an alternative approach for the assessment of the rate of radionuclide release over extended periods of time, an equilibrium concept is proposed. It postulates that all reactions which may give rise to radionuclide release will be completed after a short time and a stable final condition will establish in which for each radionuclide an equilibrium exists between a dissolved phase and the possible solid phases. Radionuclides can thereafter be released only by the aqueous phase escaping into the environment. The repositories planned in Germany comply with the assumptions underlying this approach. Release rate predictions on the basis of this concept are of particular interest for the long-lived actinides. Theoretical efforts aim at predicting equilibrium concentrations from thermodynamical data; some computer codes available for this purpose are discussed. Some results already available from corrosion studies on cemented waste forms in quinary salt brine are presented in order to illustrate the application of the equilibrium concept. For specimens doped with Cs, Sr, Pu or Am these results show that for each radionuclide a partition equilibrium exists between the corrosion products of cement and the surrounding salt brine.

2868 **(LA-UR—88-3374) Cover technology demonstration for low-level radioactive sites.** Barnes, F.J.; Warren, J.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-880839—8). NTIS, PC A03/MF A01. Order Number DE89002288/JAW.

From Annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

Preliminary results are presented on a three-year field demonstration at Los Alamos National Laboratory to evaluate the influence of different waste trench cap designs on water balance under natural precipitation. Erosion plots having two different vegetative covers (shrubs and grasses) and with either gravel-mulched or unmulched soil surface treatments have been established on three different soil profiles on an inactive waste site. Total runoff and soil loss from each plot are measured after each precipitation event. Soil moisture is measured biweekly while plant canopy cover is measured seasonally. Preliminary results from the first year show that the application of a gravel mulch reduced runoff by 73 to

90%. Total soil loss was reduced by 83 to 93% by the mulch treatment. On unmulched plots, grass cover reduced both runoff and soil loss by about 50% compared to the shrub plots. Soil moisture reduction during the growing season was more pronounced on the shrub plots. This indicates that a more complex vegetative cover provides greater soil moisture storage capacity for winter precipitation than the usual grass cover. Continued monitoring of the study site will provide data that will be used to analyze complex interactions between independent variables such as rainfall amount and intensity, antecendent soil moisture, and soil and vegetation factors, and their influence on water balance and soil erosion. 12 refs., 6 figs., 1 tab.

2869 **(NUREG/CR—5204) Low-level radioactive waste source term model development and testing: Topical report.** Sullivan, T.M.; Kempf, C.R.; Suen, C.J.; Mughabghab, S.M. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Aug 1988. Contract AC02-76CH00016. 198p. (BNL-NUREG—52160). NTIS, PC A10/MF A01 - GPO. Order Number TI89001079/JAW.

The Low-Level Waste Source Term Evaluation Project has the objective to develop a system model capable of predicting radionuclide release rates from a shallow land burial facility. The previous topical report for this project discussed the framework and methodology for developing a system model and divided the problem into four compartments: water flow, container degradation, waste form leaching, and radionuclide transport. Each of these compartments is described by submodels which will be coupled into the system model. From February 1987 to March 1988, computer models have been selected to predict water flow (FEMWATER) and radionuclide transport (FEMWASTE) and separate models have been developed to predict pitting corrosion of steel containers and leaching from porous waste forms contained in corrodible containers. This report discusses each of the models in detail and presents results obtained from applying the models to shallow land burial trenches over a range of expected conditions. 68 refs., 34 figs., 14 tabs.

2870 **(NUREG/CR—5255) Stable isotopes of authigenic minerals in variably-saturated fractured tuff.** Weber, D.S.; Evans, D.D. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Arizona Univ., Tucson (USA). Dept. of Hydrology and Water Resources). Nov 1988. 71p. NTIS, PC A05/MF A01 - GPO. Order Number TI89002740/JAW.

Identifying stable isotope variation and mineralogical changes in fractured rock may help establish the history of climatic and geomorphological processes that might affect the isolation properties of a waste repository site. This study examines the use of the stable isotope ratios of oxygen ($^{18}O/^{16}O$) and carbon ($^{13}C/^{12}C$) in authigenic minerals as hydrogeochemical tools tracing low-temperature rock-water interaction in variably-saturated fractured stuff. Isotopic compositions of fracture-filling and rock matrix minerals in the Apache Leap tuff, near Superior, Arizona were concordant with geothermal temperatures and in equilibrium with water isotopically similar to present-day meteoric water and groundwater. Oxygen and carbon isotope ratios of fracture-filling, in unsaturated fractured tuff, displayed an isotopic gradient believed to result from near-surface isotopic enrichment due to evaporation rather than the effects of rock-water interaction. Oxygen isotope ratios of rock matrix opal samples exhibited an isotopic gradient believed to result from, leaching and reprecipitation of silica at depth. Methods and results can be used to further define primary flowpaths and the movement of water in variably-saturated fractured rock. 71 refs., 23 figs., 3 tabs.

2871 **(ORNL—6519) Relative risk to the environment of aboveground hazardous material storage tanks at the Oak Ridge National Laboratory.** Payne, T.L.; Weaver, J.L. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01. Order Number DE89002535/JAW.

The Environmental Monitoring and Compliance (EMC) Section of the Environmental and Health Protection (E&HP) Division of Oak Ridge National Laboratory (ORNL) has produced a listing of the relative risks posed to the environment by each of the aboveground storage tanks (ASTs) at ORNL containing hazardous materials. This document is intended to describe the primary method utilized and provide the resulting rank-ordered listing of ORNL ASTs. The EMC Section received support in this effort from the Health and Safety Research Division, which utilized the Rapid Screening Hazard (RASH) Method to provide an assessment of the toxicity of the various materials in the storage tanks.

2872 **(PNL-SA—14904) Catalytic destruction of hazardous organics in aqueous wastes.** Baker, E.G.; Sealock, L.J. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 5p. (CONF-880437—2). NTIS, PC A02/MF A01. Order Number DE89001708/JAW.

From 5. annual Hazardous Materials Control Research Institute conference; Las Vegas, NV, USA (19 Apr 1988).

A process for catalytically destroying hazardous organics in aqueous waste streams is being developed at Pacific Northwest Laboratory (PNL). Testing in a 1-l, batch reactor demonstrated that the process could destroy 99-99.9% of various organic model compounds in water. These include aliphatics, aromatics, polycyclic aromatics, phenolics, chlorinated aromatics and chlorinated aliphatics. In the process, aqueous streams containing hazardous organics are treated with a transition metal catalyst at 300 to 450{degree}C and 2000 to 5000 psig to convert the organics to innocuous gases, primarily methane and carbon dioxide. The process can treat aqueous wastes with a wide range of organic concentrations but is probably best suited for waste streams containing 0.1 to 10.0 wt % organics. 3 refs., 3 figs., 6 tabs.

2873 **(PNL-SA—15168) In situ vitrification processing of soils contaminated with hazardous wastes.** Timmerman, C.L.; Buelt, J.L.; FitzPatrick, V.F. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 26p. (CONF-8709366—i). NTIS, PC A03/MF A01. Order Number DE89001480/JAW.

From 2. national conference on environmental and public health effects of soils contaminated with petroleum products; Amherst, MA, USA (28 Sep 1987).

In-situ vitrification (ISV) is a thermal treatment process that converts contaminated soil into a chemically inert and stable glass and crystalline product. Figure 1 illustrates how the process operates. A square array of four electrodes is inserted into the ground to the desired treatment depth. Because the soil is not electrically conductive once the moisture has been driven off, a conductive mixture of flaked graphite and glass frit is placed among the electrodes to act as the starter path. An electrical potential is applied to the electrodes, which establishes an electrical current in the starter path. The resultant power heats the starter path and surrounding soil up to 3600{degree}F (2000{degree}C), well above the initial melting temperature or fusion temperature of soils. The normal fusion temperature of soil ranges between 2000--2500{degree}F (1110--1400{degree}C). The graphite starter path is eventually consumed by oxidation, and the current is transferred to the molten soil, which is now electrically conductive. As the vitrified zone grows, it incorporates nonvolatile elements and destroys organic components by pyrolysis. The pyrolyzed by-products migrate to the surface of the vitrified zone, where they combust in the presence of oxygen. A hood placed over the processing area provides confinement for the combustion gases, and the gases are drawn into the off-gas treatment system. This paper describes the large-scale ISV system, discusses its capabilities, and summarizes the results of testing to date. 11 refs., 10 figs., 2 tabs.

2874 **(PNL-SA—16034) The distribution of strontium-90 and cesium-137 in soil profile samples from the Hanford Site and environs.** Price, K.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 5p. (CONF-8810112—6). NTIS, PC A02/MF A01. Order Number DE89001990/JAW.

From 34. annual conference on bioassay, analytical and environmental radiochemistry; Las Vegas, NV, USA (17 Oct 1988).

As a routine part of the environmental monitoring program, samples of surface soil (upper 2.5 cm) are collected annually from the Hanford Site and environs. The samples are analyzed for a

number of radionuclides, including the fission products Sr-90 and Cs-137, which could come from Site operations or worldwide fallout. The main purpose of annual sampling and analysis is to monitor the surface soil for a buildup of radioactive materials. However, because operations have continued at the Site for many years, the possibility of movement into deeper layers of the soil must be considered. A special study initiated in the spring of 1988 investigated the depth distribution of Sr-90 and Cs-137 in the upper 30 cm of soil collected from six locations on and off the Hanford Site. Results from onsite locations near operating and retired facilities were compared to those from offsite locations upwind or near the downwind perimeter of the site. Results from another onsite location were compared to profile sample results obtained at the same location in 1973. 5 refs., 1 fig., 1 tab.

2875 **(UCID—21249-Rev.1) An experiment to determine drilling water imbibition by in situ densely welded tuff.** Daily, W.; Ramirez, A. (Lawrence Livermore National Lab., CA (USA)). Apr 1987. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01. Order Number DE89002427/JAW.

Experiments were performed to determine the extent of penetration of drill water into Grouse Canyon densely welded tuff during use of normal drilling practices. Core samples were examined from a borehole cored in a rib of the Rock Mechanics drift in G-tunnel at the Nevada Test Site, Nye County, Nevada. Methylene blue dye was added to the drill water to act as a tracer which stained the rock blue on contact. We found the rock stained blue only in a thin layer about 0.5 mm thick at the surface of the core. However we were concerned about the uniformity of penetration depth observed in the core and this prompted a simple experiment to test the ability of methylene blue to penetrate the matrix of densely welded tuff. We found that in the imbibition process, the dye and water separated such that the water penetrated the matrix to a much greater depth. This result meant that any interpretation of drill water imbibition in borehole core based on this dye as a tracer is unreliable. More important, however, is the conclusion that the presence of methylene blue dye on the rock indicates the presence of tracer water flow, but the absence of the dye does not rule out the presence of water flow. 6 refs.

2876 (UCRL—53868-87, pp 10.46-10.48) **Evaluating reconstruction algorithms for electrical impedance tomography.** Yorkey, T.J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The author has developed an improved electrical-impedance tomographic-reconstruction algorithm that is based on a modified Newton-Raphson method. The algorithm is generally guaranteed to converge - that is, it will find a set of resistivities that fits a set of voltage measurements in a least-squares sense. The author compares results from two-dimensional computer simulations with reconstruction algorithms based on methods proposed by other authors. The modified Newton-Raphson method provided significantly better reconstructions than the other methods tried. This improved reconstruction algorithm will help the Nuclear Waste Management Program in geophysical core-sample analysis.

2877 **(USGS-OFR—87-649) Temperature, thermal conductivity, and heat flow near Yucca Mountain, Nevada: Some tectonic and hydrologic implications.** Sass, J.H.; Lachenbruch, A.H.; Dudley, W.W. Jr.; Priest, S.S.; Munroe, R.J. (Geological Survey, Reston, VA (USA)). 1988. Contract AI08-78ET44802. 118p. NTIS, PC A06/MF A01. Order Number DE89002697/JAW.

Repeated temperature logs were obtained in 18 geologic and hydrologic test wells near Yucca Mountain, Nevada. Single logs were also obtained (using a specially designed sonde with fast response in air) in the air column of 17 wells drilled to monitor water level below and around Yucca Mountain. The temperature data suggest that the thermal regimes of both the saturated and unsaturated zones are strongly influenced by a complex hydrologic regime in the saturated tuffs and underlying Paleozoic carbonate rocks. Temperature gradients in the unsaturated zone (UZ) appear primarily conductive, but they range from about 15{degree}C km/sup {minus}1/ to nearly 60{degree}C km/sub {minus}1/. However, one profile indicates rapid penetration to a depth of 150 m beneath a major channel by water from run-off following a local heavy rain. From the water table (which ranges in depth from about 300 m to over 700 m) to depths of 1 km or more, the temperature gradient in the saturated zone (SZ) typically is very irregular with evidence for locally controlled water movement in the Tertiary volcanic rocks, laterally and both up and down vertically. Vertical seepage velocities inferred from one-dimensional hydrologic models range from a few millimeters to 100 millimeters or more per year. Below depths of 1 km, temperature profiles are linear, suggesting conductive heat flow, but as in the case of the UZ, the gradients are quite variable, suggesting that the heat flux here is being controlled by fluid flow in the Paleozoic carbonate aquifer that underlies Yucca Mountain. 26 refs., 18 figs., 6 tabs.

2878 **(WHC-EP—0046) Recharge estimate for the Hanford Site 200 Areas plateau.** Routson, R.C.; Fuchs, M.R.; Jordan, W.A. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1988. Contract AC06-87RL10930. 11p. NTIS, PC A03/MF A01. Order Number DE89003015/JAW.

An evaluation was made to assess the magnitude of recharge from natural precipitation on the Hanford Site 200 Areas plateau. Two sources of data were used in the evaluation moisture accumulation in a 200 East Area closed-bottom lysimeter for 13 yr, and distribution of ^{137}Cs in a solid-waste trench in which contaminated soil had been buried for 10 yr. Cesium-137 contaminated soil was placed in a solid-waste burial ground. After 10 yr, the distribution of ^{137}Cs detected beneath the trench bottom above the background radiation level. Thus, there was no measurable downward recharge. However, ^{137}Cs was detected above the trench suggesting negative recharge. In summary, the recharge rate was found to be zero or negative, within the estimated error of measurement, for two locations on the Hanford Site 200 Areas plateau. 11 refs., 5 figs.

2879 **(WHC-EP—0065) Electrochemical corrosion-scoping experiments: An evaluation of the results.** Smith, H.D. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 56p. NTIS, PC A04/MF A01. Order Number DE89000691/JAW.

Prior to emplacement in a nuclear waste repository, each waste form must be well characterized with respect to its behavior in the environments expected to develop in the repository. This scoping study was designed to obtain a qualitative idea of how spent fuel cladding would respond to a hot water environment that could develop in a tuff repository at a time when temperatures have cooled to {approximately}95{degree}C and hot liquid water has infiltrated the repository horizon. That information would then be used to establish more definitive tests on cladding behavior in a tuff repository. For this study bundles of spent fuel cladding held together with a 304 stainless steel (SS) wrap were constructed which simulate the geometries and materials associations in a breached 304L SS container. They were exposed to 90{degree}C tuff-equilibrated Well J-13 water for periods of 2, 6, and 12 mo. During the experiments, the water level, temperature, conductivity, and pH were monitored on a regular basis. The water was also checked periodically for carbon (organic, inorganic, and later in the experiment Carbon-14) and zirconium. More extensive water analyses were carried out at the midpoint and completion of the experiments. 12 refs., 16 figs., 5 tabs.

2880 **(WHC-EP—0141) Westinghouse Hanford Company effluent releases and solid waste management report for 1987: 200/600/1100 Areas.** Coony, F.M.; Howe, D.B.; Voigt, L.J. (Westinghouse Hanford Co., Richland, WA (USA)). May 1988. Contract AC06-87RL10930. 289p. NTIS, PC A13. Order Number DE89002164/JAW.

The purpose of this report is to fulfill the reporting requirements of US Department of Energy (DOE) Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements. Quantities of airborne and liquid wastes discharged by Westinghouse Hanford Company (Westinghouse Hanford) in the 200 Areas, 600 Area, and 1100 Area in 1987 are presented in this report. Also, quantities of solid wastes stored and buried by Westinghouse Hanford in the 200 Areas are presented in this report. The report is also intended to demonstrate compliance

with Westinghouse Hanford administrative control limit (ACL) values for radioactive constituents and with applicable guidelines and standards for nonradioactive constituents. The summary of airborne release data, liquid discharge data, and solid waste management data for calendar year (CY) 1987 and CY 1986 are presented in Table ES-1. Data values for 1986 are cited in Table ES-1 to show differences in releases and waste quantities between 1986 and 1987. 19 refs., 3 figs., 19 tabs.

2881 **(WHC-EP—0150) Grout Treatment Facility environmental baseline and site characterization report.** Swanson, L.C.; Weekes, D.C.; Luttrell, S.P.; Mitchell, R.M.; Landeen, D.S.; Johnson, A.R.; Roos, R.C. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 249p. NTIS, PC A11/MF A01. Order Number DE89002503/JAW.

The Grout Treatment Facility (GTF) site is planned for use as a shallow land burial site for the disposal of low-level liquid radioactive waste that is solidified mixing the waste with a cementitious grout material. To determine if the GTF is impacting the environment at any time during future operations, two preliminary objectives must be completed: the preoperational environmental conditions must be described, and the baseline parameters of the physical system must be defined. Both objectives were addressed by conducting site characterization activities and using the collected data to establish a baseline (background) that describes the current physical system and how this system will eventually change through time. The specific physical systems for which baselines were determined and characterization was completed at the GTF site including the following: atmospheric, radioecologic, geologic, and hydrologic. Data collection has been continuous since 1984. The US Department of Energy's regulations and Westinghouse Hanford Company internal policies guided the studies. The 0.4 mi^2 GTF site is located in the Pasco Basin in south-central Washington State at the Hanford Site. Atmospheric and thermoluminescent dosimeter (TLD) data were collected from an existing routine environmental surveillance network and at three other stations established for this investigation to measure levels of radiation at the GTF site. The atmospheric data indicated that airborne radionuclide levels were below maximum permissible concentrations from 1985 through 1987. The TLD results for the three constructed stations ranged from 84 to 97 mrem/yr in 1987. This represents an increase (about 10%) from the 1986 dosage values. 32 refs., 22 figs., 7 tabs.

2882 **(WHC-EP—0182-4) Tank farm surveillance and waste status summary report for July 1988.** Thurman, J.M. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 30p. NTIS, PC A03/MF A01. Order Number DE89002137/JAW.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored high-level waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 underground waste tanks, as well as to provide supplemental information regarding tank equipment, tank anomalies, and ongoing investigations.

2883 **(WHC-SA—0301) Engineered surface barriers for waste disposal sites: Lysimeter facility design and construction.** Phillips, S.J.; Ruben, M.S.; Kirkham, R.R. (Westinghouse Hanford Co., Richland, WA (USA); Kaiser Engineers Hanford Co., Richland, WA (USA); Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-87RL10930;AC06-76RL01830. 13p. (CONF-881054—30). NTIS, PC A03/MF A01. Order Number DE89002140/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

A facility to evaluate performance of engineered surface barriers for confinement of buried wastes has been designed, constructed, and operations initiated. The Field Lysimeter Test Facility is located at the US Department of Energy's Hanford Site in Richland, Washington. The facility consists of 18 one-dimensional drainage and weighing lysimeters used to evaluate 7 replicated barrier treatments. Distinct layers of natural earth materials were used to construct layered soil and rock barriers in each lysimeter. These barrier designs are capable in principle of significantly reducing or precluding infiltration of meteoric water through barriers into underlying contaminated zones. This paper summarizes salient facility design and construction features used in testing of the Hanford Site's engineered surface barriers. 7 refs., 1 fig.

2884 **(ORNL/tr—88/29) Treatment method for stabilization of radioactive exchange resin.** Hideo, Oni; Takashi, Miyake; Hitoshi, Miyamoto; Toshio, Funakoshi; Yuzo, Inagaki. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. Translation of Japanese Patent Application No. 62-116300, May 27, 1987. 8p. NTIS, PC A02/MF A01. Order Number DE89001028/JAW.

This is a method for eluting radioactive nuclides from a radioactive ion exchange resin in which it has been absorbed. First, the Cs in this resin is extracted using a neutral salt solution which contains Na^+. The Cs that has been transferred to the neutral salt solution is absorbed and expelled by inorganic ion exchangers. Then the Co, Fe, Mn and Sr in said resin are eluted using an acidic solution; the Co, Fe, Mn and Sr that have been transferred to the acidic solution are separated from that solution by means of a diffusion dialysis vat. This process is a unique characteristic of this ion exchange resin treatment method. 1 fig.

2885 **Application of a mixing cell model to describe contaminant transport - An example of appropriate technology.** Price, J.B. (Sergent, Hauskins and Beckwith Geotechnical Engineers Inc., Albuquerque, NM (US)). pp 197-204 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

The Uranium Mill Tailings Remedial Action (UMTRA) Project is undertaking remedial actions at designated inactive uranium mill sites. The mill tailings lie within an alluvial floodplain adjacent to the Colorado River. Mancos Shale with hydraulic conductivity of 5x10/sup -4/ to 2x10/sup -7/ cm/sec lies below four to more than six meters (13.1 to 19.7 feet) of alluvium. The mill site is surrounded by industry and residences of the city of Grand Junction. Ground water in the alluvium flows generally parallel to the Colorado River with the Colorado River adjacent to the mill site being an effluent stream during the fall and winter and an influent stream during the spring snowmelt runoff. In the vicinity of the tailings, the saturated thickness of the alluvium ranges from less than 3.05, meters (10 feet) to more than 6.10 meters (20 feet). Portions of the tailings are below the water table.

2886 **The UMTRA Project's water analysis quality assurance program; Part 2: Post-laboratory selection control.** Rice, G.; Brinkman, J.E. (Sergent, Hauskins and Beckwith Geotechnical Engineers Inc., Albuquerque, NM (US)). pp 191-196 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

Unreliable results led the UMTRA Project to establish a two-phase quality assurance program for the analysis of water samples. At the same time, a stringent set of protocols designed to assure proper sampling and field testing of water samples by UMTRA Project personnel was implemented. In the first phase of the program, eight laboratories participated in a pre-qualification process. Each laboratory analyzed three solutions of known composition. The accuracy of each laboratory's analyses was scored and three laboratories were selected to receive contracts. Although the cost of analyses was not considered in the selection process, the differences in the prices charged by the three laboratories are interesting. Laboratory "A" charges $447.00 for an analysis of all the constituents in Table 1. Laboratory "B" $235.00, and laboratory "C" $575.00. The pre-qualification phase is described in the first part of this paper. This part of the paper discusses the second phase of the quality assurance program, the post-award monitoring of laboratory results.

2887 The UMTRA Project's water analysis quality assurance program; Part 1: Laboratory selection. Brinkman, J.E.; Rice, G.; Muller, D. (Sergent, Hauskins and Beckwith Geotechnical Engineers Inc., Albuquerque, NM (US)). pp 185-190 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

During the Uranium Mill Tailings Remedial Action (UMTRA) Project, quarterly water samples will be collected at and around most of the 24 processing sites and additional samples will be collected during the following remedial action. The chemical nature of these samples will vary from drinking water quality to water with total dissolved solids contents in excess of 50,000 mg/l. Considering the wide range of water quality and the requirement of accurate analyses, a stringent quality assurance program has been implemented for the UMTRA Project. The first phase of the program was a pre-qualification of acceptable laboratories. A summary of analytical results from all participating laboratories and a discussion of these results are presented in this paper.

2888 UMTRA Project: Implementation of design. Matthews, M.L. (US Dept. of Energy, Albuquerque, NM (US)). pp 15-22 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

In 1978, Congress enacted Public Law 96-604, the "Uranium Mill Tailings Radiation Control Act of 1978." Title I of the Act instructed the Department of Energy (DOE) to perform remedial actions at designated inactive uranium mill tailings sites. The Uranium Mill Tailings Remedial Actions (UMTRA) Project Office of DOE is implementing remedial actions at 24 sites, in cooperation with the affected States, Indian tribes and Nuclear Regulatory Commission. Remedial actions began at the first site in 1983, and all sites are planned to be cleaned up by 1990. Environmental Protection Agency cleanup standards for inactive sites are being used as the criteria for the cleanup project. The remedial action effort at the sites where work has begun or will begin soon is discussed.

2889 Waste containment and monitoring system for the Niagara Falls Storage Site. Jones, M.G.; Blanke, J.A. (Bechtel National Inc., Advanced Technology Div., Oak Ridge, TN (US)). pp 537-546 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

The U.S. Department of Energy has established an interim storage site for low-level radioactive waste, known as the Niagara Falls Storage Site, near Lewiston, New York. The main elements of the waste containment facility at the site are: a clay cutoff wall keyed into an underlying clay stratum, a surface dike built on top of the cutoff wall, and a layered cap over the waste. The integrity of the waste containment facility will be monitored using groundwater monitoring wells, periodic topographic surveys, aerial photographic surveys, and walkover surveys. In addition to external monitoring, an internal monitoring system will be installed in the waste containment facility. The principal design restriction for this system is prevention of any direct penetrations on the cap or sidewalls of the containment facility. The instruments selected for the internal monitoring system are remote readout pressure transducers of the vibrating wire and pneumatic types. These transducers will be used to monitor changes in the potentiometric surface and temperature in the waste. The pressure transducers are connected to a remote readout station by cables and tubing, which are placed in trenches. The waste containment facility and the monitoring system developed to measure its performance are described, wit' emphasis on the internal instrumentation.

2890 Transport of chemicals in the groundwater system at a site near Weldon Spring, Missouri. Benioff, P.A.; Yang, J.Y. (Argonne National Lab., IL (US)). pp 457-466 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

The Weldon Spring site is part of the former Weldon Spring Ordnance Works used by the U.S. Department of the Army for the manufacture of TNT and DNT in the 1940s. The site is located about 23 km southwest of St. Charles, Missouri, and about 48 km west of St. Louis. In the mid 1950s, 81 ha of the Ordnance Works was transferred to the U.S. Atomic Energy Commission (AEC) for construction and operation of a uranium and thorium processing facility (now called the chemical plant). During operations, which ceased in 1966, radioactive sludge residues (raffinates) were stored in four onsite pits (the raffinate pits). A nearby quarry, located 7 km south of the plant, was used to store other contaminated material and rubble. The locations of the quarry, raffinate pits, and chemical plant are shown. In this study, two alternatives are compared to evaluate the effectiveness of waste stabilization and isolation at the raffinate pits area: (1) no action, and (2) improved containment. Under the no-action alternative, current maintenance and monitoring practices would be continued for the contaminated materials in the raffinate pits. Under the improved-containment alternative, stabilized raffinate and quarry sludges would be stored in the raffinate pits along with contaminated materials from the quarry, chemical plant, and nearby vicinity properties. Multilayered covers - each consisting of 1.5 m clay, 0.15 m sand, 0.9 m riprap, 0.15 m sand, and 0.46 m topsoil in ascending order - would be constructed over the four pits. The area around the raffinate pits would then be cleared, graded, covered with 15 cm topsoil, and planted with grass.

2891 Monitoring in the vadose zone at two inactive uranium mill tailings sites. Hilton, J.; Colarullo, S. (Roy F. Weston Inc., Albuquerque, NM (US)). pp 439-446 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

The Uranium Mill Tailings Radiation Control Act of 1978, Public Law 95-604, authorized the U.S. Department of Energy (DOE) to perform remedial action at designated sites. One of these sites is the Monument Valley, Arizona, inactive uranium mill tailings site. The Monument Valley tailings are currently being studied by the Technical Assistance Contractor (TAC) to DOE to characterize the site and to make recommendations for remedial action. The study includes characterization of contaminant migration in the vadose zone. Computer modeling was initiated to predict seepage rates through the tailings and underlying alluvium. A monitoring network of suction water samplers and tensiometers was set up to measure field conditions. Darcy's Law was used to calculate the flux through the pile. These seepage values were then compared to the computer estimated seepages. The monitoring program was designed on the basis of a successful vadose zone study completed at the Riverton, Wyoming, tailings site, which is similar both climatically and geologically to the Monument Valley site. Measurements obtained from the Riverton instruments were successfully used to define the rate of vertical movement of residual pore water, infiltrating rainfall, and dissolved solutes through the Riverton pile and into the underlying aquifer. This paper summarizes the results of the Riverton study and describes the vadose zone monitoring network that was installed at Monument Valley based on that study.

2892 Pathway analysis for a contaminated landfill in Middlesex, New Jersey. Yu, C.; Merry-Libby, P.; Yang, J.Y. (Argonne National Lab., IL (US)). pp 429-438 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

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The Middlesex Municipal Landfill is located in Middlesex, New Jersey, about 29 km southwest of Newark, New Jersey. It is one of several properties in the Borrough of Middlesex and Township of Piscataway that have been identified as being radioactively contaminated as a result of work that was carried out on various uranium, thorium, and beryllium ores at the Middlesex Sampling Plant. Most of the contaminated properties have been cleaned up and the contaminated materials are being stored in a large interim storage pile at the sampling plant site. In 1948, during some renovations at the sampling plant, about 4,600 m/sup 3/ of excess soil contaminated with uranium ore was apparently transported and disposed in the landfill gully area next to Bound Brook. In 1961, the Atomic Energy Commission removed about 500 m/sup 3/ of near-surface radioactively contaminated material from the landfill and covered the area with 0.6 m of clean soil. From 1961 to 1974 (when the landfill was closed), an additional 2.4 to 3.0 m of fill material was placed in the landfill. Under the Formerly Utilized Sites Remedial Action Program, the U.S. Department of Energy began excavating contaminated materials from the landfill in 1984. A total of 16,000 m/sup 3/ of landfill materials covering a 0.2-ha area was excavated, of which 11,000 m/sup 3/ was contaminated and has been transported to the nearby sampling plant site for interim storage.

2893 **Some views on geotechnical and regulatory aspects of uranium mine and mill tailings disposal-stabilization management.** Parate, N.S. (Oak Ridge National Lab. and Tennessee State Univ., TN (US)). pp 381-390 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

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It is evident from the state of the art and the ongoing efforts worldwide that by making use of the best practicable engineering technology and human mind, it is possible to adopt appropriate remedial actions for uranium mill tailings or other nuclear wastes and to fully serve the purpose of the intent of the recent UMTRA act. Over the timescales such as discussed above sociological, technological, climatological and geomorphological changes can be expected to occur. Since the nature and the extent of these changes cannot be anticipated today, our responsibility to future generations requires that uranium mill tailings be securely contained and stabilized for an indefinite period, using the best practicable technology currently available. Thus the design and construction of facilities should be optimised in a sound engineering manner within realistic and practical perspectives of risks, costs and benefits.

2894 **Emergence of interest groups on hazardous waste siting: How do they form and survive.** Williams, R.G.; Payne, B.A. (Argonne National Lab., IL (US)). pp 367-374 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

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The disposal and siting of hazardous and radioactive wastes has created numerous problems for decision-makers in the field of waste management. The social/political problems have proven to be some of the most difficult to solve. Public knowledge of the presence of hazardous and radioactive waste sites has grown considerably in recent years. Over the same period, the process of choosing new disposal sites has attracted a great deal of publicity. In many cases, when existing sites are discovered or when a community is being considered for a new disposal site, organized groups emerge in the community to support or oppose the proposed actions and the decision-makers responsible. Emergent groups are a form of organized collective action in response to a particular situation or event, such as the siting or discovery of a hazardous waste disposal site. Sociological methods and theory can provide insight on the patterns common to these groups, their emergence, and their survival or decline. The questions addressed in this paper are: what are the variables that lead to the formation of such groups, and what conditions or group actions contribute to their growth and survival?

2895 **Design of drainage facilities for the UMTRA project.** Agogino, K.; Keshian, B. Jr.; Portillo, R. (Roy F. Weston Inc., Albuquerque, NM (US)). pp 163-172 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

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It is extremely important that the integrity of the remedial action performed at the Uranium Mill Tailings Remedial Action (UMTRA) Project sites be maintained for the design life of the facility (200 to 1000 years). This requires erosion protection both on and adjacent to the tailings pile. The standard design approach is to protect the tailings embankment and radon barrier system from the runoff resulting from a Probable Maximum Precipitation (PMP). Often drainage facilities are needed to convey the runoff from the pile and the runoff from any drainage areas that would impinge upon the embankment. Design of these facilities presents unique problems when designing for long-term performance under PMP conditions. This paper discusses the decision process involved during the selection and design of optimum drainage facilities. Case studies of the Durango, Colorado, and Lakeview, Oregon, disposal sites are presented.

2896 **Estimates of vertical hydraulic conductivity in the middle Dakota Sandstone, Monticello, Utah.** Kautsky, M.; Kearl, P.M.; Dexter, J.J.; Zinkl, R.J. (Bendix Field Engineering Corp., Grand Junction, CO (US)). pp 143-152 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

There are about 2 million tons of uranium mill tailings which lie directly on top of an alluvial aquifer at the Monticello millsite, Utah. The aquifer is contaminated as a consequence of leachate percolating through the tailings. The Burro Canyon Formation which is the local culinary aquifer, underlies the site at depth, but is isolated from the alluvial aquifer by an aquitard composed primarily of middle Dakota Sandstone, and some Mancos Shale. Water quality monitoring of the Burro Canyon aquifer has indicated that it contains very low to no contamination by radionuclides. Tritium data have shown that the recharge to the aquifer predates 1953. Pump tests conducted on the system using the ratio method, have shown the vertical hydraulic conductivity of the aquitard is some 5.2 x 10/sup -7/ to 8.0 x 10/sup -9/ m/d (1.7 x 10/sup -6/ to 2.6 x 10/sup -8/ ft/d). Based upon the aquifer monitoring and test data, the middle Dakota Sandstone appears to be an effective aquitard impeding the downward migration of contaminants from the alluvial aquifer to the Burro Canyon aquifer.

2897 **Groundwater pathway sensitivity analysis and hydrogeologic parameters identification for waste disposal in porous media.** Yu, C. (Argonne National Lab., IL (US)). pp 133-142 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

The migration of radionuclides in a geologic medium is controlled by the hydrogeologic parameters of the medium such as dispersion coefficient, pore water velocity, retardation factor, degradation rate, mass transfer coefficient, water content, and fraction of dead-end pores. These hydrogeologic parameters are often used to predict the migration of buried wastes in nuclide transport models such as the conventional advection-dispersion model, the mobile-immobile pores model, the nonequilibrium adsorption-desorption model, and the general group transfer concentration model. One of the most important factors determining the accuracy of predicting waste migration is the accuracy of the parameter values used in the model. More sensitive parameters have a greater influence on the results and hence should determined (measured or estimated) more accurately than less sensitive parameters. A formal parameter sensitivity analysis is carried out in this paper. Parameter identification techniques to determine the hydrogeologic parameters of the flow

system are discussed. The dependence of the accuracy of the estimated parameters upon the parameter sensitivity is also discussed.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 2826, 2827, 2829, 2830, 2831, 2832, 2833, 2834, 2841, 2842, 2843, 2845, 2846, 2847, 2848, 2849, 2850, 2851, 2852, 2868, 2869, 2870, 2871, 2872, 2873, 2874, 2875, 2877, 2878, 2880, 2881, 2882, 2883, 3549

2898 (DOE/WIPP—87-005) Waste drum fire propagation at the Waste Isolation Pilot Plant. (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Apr 1987. Contract AC04-86AL31950. 48p. NTIS, PC A03/MF A01. Order Number DE89002770/JAW.

An accident scenario had been postulated at WIPP in which spontaneous ignition of the contents of a CH-TRU waste container, combined with a flow of air to the burning waste material, results in fire propagation to adjacent containers and throughout the storage room. The Waste Drum Fire Propagation Task Force was formed to evaluate the credibility of a fire propagation scenario. Goals of the task force included evaluation of existing information regarding the likelihood of waste drum fire propagation, determination of the credibility of such a scenario at WIPP, and assessment of the need for salt backfill as a fire deterrent in TRU storage areas. The analysis presented in this report assumes no backfilling of the emplaced waste. It was recognized by the Task Force, however, that if the results of this analysis indicate that a propagating fire (assuming no backfill) is a credible event at WIPP, the potential effectiveness of salt backfill as well as other methods of fire control would need to be evaluated. The approach used to resolve these concerns as well as conclusions reached by the Task Force are described in subsequent sections. 10 refs., 2 figs., 2 tabs.

2899 Implications of an assessment of potential organic contamination of ground water at an inactive uranium mill. Price, J.B. (Sergent, Hauskins and Beckwith Geotechnical Engineers Inc., Albuquerque, NM (US)). pp 247-254 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

Laws and regulations concerning remedial actions at inactive uranium mills explicitly recognize radiological and nonradiological hazards and may implicitly recognize the potential presence of hazardous wastes at these mill sites. Ground-water studies at the sites have placed an increasing emphasis on screening for priority pollutants. The Grand Junction, Colorado, mill site was deemed to have a high potential for the presence of organic compounds in ground water, and was chosen as a prototype for assessing the presence of organic compounds in ground water at inactive sites. Lessons learned from the assessment of organics at the Grand Junction site were used to develop a screening procedure for other inactive mill sites.

0540 Health And Safety

REFER ALSO TO CITATION(S) 2835, 3052, 3064, 3301, 3356

2900 (LA-UR—88-3124) Self limiting features of accidental criticality in a solution system. Malenfant, R.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8809144—1). NTIS, PC A02/MF A01. Order Number DE89000347/JAW.

From DOE criticality alarm system workshop; Richland, WA, USA (20 Sep 1988).

Experience with the SHEBA solution critical assembly during validation testing of accidental criticality alarm detectors provided several insights into the character of potential accidental excursions. Two observations were of particular interest. First, it is nearly impossible to maintain a solution system, particularly one employing low-enrichment material, in a constant state. If supercritical, the system will heat up, expand (or form bubbles), return to a sub-critical state, and shut down of its own accord without going into short period oscillations. Second, a very slow change in the system could produce a long "pulse" resulting in lengthy exposures, a high dose, but a low dose rate. The experiments dramatically contradicted the popular contention that accidental criticality is characterized by a blue flash, a clap of thunder, and violet expulsion of material. 5 refs., 3 figs., 4 tabs.

2901 (UCRL—50007-87) Hazards Control Department annual technology review, 1987. Griffith, R.V.; Anderson, K.J. (eds.). (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 149p. NTIS, PC A07/MF A01. Order Number DE89002470/JAW.

This document describes some of the research performed in the LLNL Hazards Control Department from October 1986 to September 1987. The sections in the Annual report cover scientific concerns in the areas of Health Physics, Industrial Hygiene, Industrial Safety, Aerosol Science, Resource Management, Dosimetry and Radiation Physics, Criticality Safety, and Fire Science. For a broader overview of the types of work performed in the Hazards Control Department, we have also compiled a selection of abstracts of recent publications by Hazards Control employees. Individual reports are processed separately for the data base.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 3064

2902 (LA-UR—88-2780) Rugged, lightweight, and long-operating hand-held instruments for neutron and gamma-ray verification measurements. Fehlau, P.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-881232—1). NTIS, PC A02/MF A01. Order Number DE88016163/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

Los Alamos National Laboratory is a developer of intelligent, hand-held instruments for detecting special nuclear materials. These have used NaI(Tl) or plastic scintillation detectors and discrete or microprocessor digital alarm circuitry to permit nonspecialists to detect low-intensity sources. Two new instruments have the added ability to verify the presence or absence of certain nuclear materials: one instrument uses a ^{6}LiI(Eu) scintillator and pulse-height analysis to verify the presence or absence of plutonium by measuring neutron intensity at a container surface; the other uses an LED-stabilized, NaI(Tl) scintillator and three single-channel analyzers to measure and strip Compton background from a gamma-ray peak or region of interest to verify that certain isotopes of plutonium or particular enrichments of uranium are present or absent. The new instruments are lightweight, low power, and easily operated in the field by nonspecialists. 10 refs., 6 figs.

2903 (LA-UR—88-3295) NDA accountability measurement needs in the DOE plutonium community. Ostenak, C.A. (Los Alamos National Lab., NM (USA)). 31 Aug 1988. Contract W-7405-ENG-36. 21p. (CONF-8810174—3). NTIS, PC A03/MF A01. Order Number DE89000323/JAW.

From Plutonium/uranium recovery operations conference; Idaho Falls, ID, USA (4 Oct 1988).

The purpose of this first ATEX report is to identify the twenty most vital nondestructive assay (NDA) accountability measurement needs in the DOE plutonium community to DOE and to contractor safeguards R&D managers in order to promote resolution of these needs. During 1987, ATEX identified sixty NDA accountability measurement problems, many of which were common to each of the DOE sites considered. These sixty problems were combined into twenty NDA accountability measurement needs that exist within five major areas: NDA "standards" representing various nuclear materials and matrix composition; Impure nuclear materials compounds, residues, and wastes; Product-grade nuclear materials; Nuclear materials process holdup and in-process inventory; and Nuclear materials item control and verification. 2 figs.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 2830, 2893, 3052, 3064

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0702 Radiation Sources

2904 **(INIS-mf—11837) Cs-137 for irradiation of sewage sludge. Final report.** Lessel, T. (Abwasserverband Ampergruppe, Eichenau (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 27 Mar 1986. 6p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755578/JAW.

Since 1973, the Geiselbullach sewage treatment works have been continuously operating their first system for gamma irradiation of sewage sludge. Within the framework of a German-American agreement, nine Cs-137 sources with a total activity of 56.000 Ci have been made available to the works free of charge in 1983, in order to test in practice and to demonstrate the applicability of these radiation sources in comparison to the Co-60 sources exclusively used up to then. This first study on the applicability of Cs-137 as a radiation source for sewage sludge treatment revealed no findings or effects speaking against Cs-137 as a radiation source for this purpose.

2905 **(UCID—21532) Summary of mirror experiments relevant to beam-plasma neutron source.** Molvik, A.W. (Lawrence Livermore National Lab., CA (USA)). 18 Oct 1988. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01. Order Number DE89002540/JAW.

A promising design for a deuterium-tritium (DT) neutron source is based on the injection of neutral beams into a dense, warm plasma column. Its purpose is to test materials for possible use in fusion reactors. A series of designs have evolved, from a 4-T version to an 8-T version. Intense fluxes of 5--10 MW/m^2 is achieved at the plasma surface, sufficient to complete end-of-life tests in one to two years. In this report, we review data from earlier mirror experiments that are relevant to such neutron sources. Most of these data are from 2XIIB, which was the only facility to ever inject 5 MW of neutral beams into a single mirror call. The major physics issues for a beam-plasma neutron source are magnetohydrodynamic (MHD) equilibrium and stability, microstability, startup, cold-ion fueling of the midplane to allow two-component reactions, and operation in the Spitzer conduction regime, where the power is removed to the ends by an axial gradient in the electron temperature T/sub e/. We show in this report that the conditions required for a neutron source have now been demonstrated in experiments. 20 refs., 15 figs., 3 tabs.

0703 Isotopic Power Supplies

REFER ALSO TO CITATION(S) 2971

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 2751, 2922

0802 Storage

2906 (INIS-BR—1275, pp 7) **Hydrogen localized vibrations in Ti/sub 0.8/ Zr/sub 0.2/ CrMnH/sub 3/ storage compound: study by neutron inelastic scattering.** Mestnik Filho, J.; Vinhas, L.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

2907 **(DOE/PC/79817—1-Rev.1) Direct conversion of methane to C_2's and liquid fuels: First quarterly technical progress report, October 1--December 31, 1987.** Warren, B.K.; Campbell, K.D. (Union Carbide Corp., South Charleston, WV (USA). Solvents and Coatings Materials Div.). 15 Jun 1988. Contract AC22-87PC79817. 56p. NTIS, PC A04/MF A01. Order Number DE89002158/JAW.

Methane oxidative coupling studies were carried out in an atmospheric quartz reactor at temperatures between 700 and 800{degree}C. New catalysts prepared and studied included doped alkaline earth catalysts, lanthanide oxides, and proprietary catalysts. Neodymium oxide, Nd_2O_3, was found to be as active and selective as samarium oxide, Sm_2O_3, in contrast to literature reports. Proprietary Union Carbide catalysts (UCC-S:1) showed initial methane conversions and C_2 selectivities comparable to literature catalysts. Atypically low carbon dioxide to carbon monoxide ratios (typically ten times lower than those seen in the literature or other catalysts tested) and high ethylene to ethane ratios (3 to 6 compared to typical literature ratios below 1) were obtained. These results are interesting because ethylene is more valuable than ethane and carbon monoxide is more valuable than carbon dioxide. With these UCC-S:1 catalysts, rapid deactivation was coupled with an observed shift in product ratios toward those more typical in the literature. Initial cases for process conceptualization studies were selected. The Comparison Case will consist of the conversion sequence from methane to synthesis gas to methanol to olefins to liquid hydrocarbon fuels. Case 1 will consist of the conversion of methane to ethylene and ethane. Case 2 will be the direct conversion of methane to C_2's followed by conversion to liquid hydrocarbon fuels. 7 figs., 18 tabs.

2908 **Enzyme semisynthesis by conformational modification of proteins/sup α/.** Keyes, M.H.; Albert, D.E.; Saraswathi, S. (Anatrace Inc., 1280 Dussel Drive, Maumee, OH (US)). pp 201-204 of Enzyme engineering 8. Laskin, A.I.; Mosbach, K.; Thomas, D.; Wingard, L.B. New York, NY; The N.Y. Academy of Sciences (1987). (CONF-8509443—).

From 8. enzyme engineering; Helsingor, Denmark (22 Sep 1985).

Although enzymes are extremely efficient catalysts, they often possess properties not suitable for commercial applications. For example, the pH at which an enzyme is optimally active may not be compatible with a desired reaction. Often an enzyme requires cofactors that are expensive and not easy to regenerate. Even more difficult to circumvent is substrate specificity, which may cause an enzyme to catalyze a desired reaction poorly, while a side reaction proceeds very efficiently. Changing the properties of an enzyme is often a difficult and unpredictable task even by genetic engineering. Semisynthesis of enzymes is an appealing concept because it promises to generate catalysts that are as efficient as natural enzymes, but possess different properties. One might even hope to observe catalytic activity against a substrate that remains untouched by any native enzyme. One method to prepare semisynthetic enzymes involves substituting one segment of a natural enzyme with a synthetic peptide; this semisynthetic enzyme will possess catalytic activity similar to the starting enzyme with perhaps altered kinetics. Of even greater interest in terms of commercial applications are semisynthetic enzymes that possess new catalytic activities that the starting enzymes lack. One approach to generate such semisynthetic enzymes reporter by Kaiser, involves the covalent linkage of flavin derivatives to the active site of papain to induce oxido-reductase activities. In this paper, the authors describe a novel and versatile approach to induce new catalytic activities in proteins, by means of conformational modifications. The method involves the following four steps: (1) Selection of a starting or host protein, (2) Perturbation of the native state of the protein. (3) Addi-

tion of modifier to change protein conformation. (4) Crosslinking protein with bifunctional reagent.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 3134

0904 Solid Waste And Wood Fuels

2909 **(PB—88-244744/XAB) Arizona's 1984 fuelwood harvest. Forest Service resource bulletin.** McLain, W.H. (Forest Service, Ogden, UT (USA). Intermountain Research Station). Aug 1988. 12p. (FSRB/INT—57). NTIS, PC A03/MF A01.

Highlights the 1984 harvest of fuelwood in Arizona by commercial fuelwood harvesters and those cutting for home consumption are given. Harvest volumes by species, county, and owner are presented. A directory of commercial fuelwood harvesters is listed, and the methods of data collection and compilation are described.

13 Economics And Management

REFER ALSO TO CITATION(S) 2793

14 SOLAR ENERGY

1401 Resources And Availability

REFER ALSO TO CITATION(S) 3492

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 2908, 2927, 3238

2910 **(AU/P—80) Photovoltaic Effect in Cu/sub 2/0. Final report.** Weichman, F.L.; Berezin, A.A. (Alberta Univ., Edmonton (Canada). Dept. of Physics). 1980. 62p. (CE—01985). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes results of a preliminary program intended to investigate copper-copper oxide solar cells with a view to maximizing their power output and finding ways to manufacture the cells at low cost. After a review of past research and a summary of photovoltaic principles, various cell fabrication techniques are evaluated. Oxidized cells were made by oxidizing pure copper under a flow of CO-CO/sub 2/ gas mixture. This technique enabled an oxide layer to be grown at an arbitrarily slow speed, and temperature was regulated to obtain Cu/sub 2/O layers grown for predetermined properties. The oxide layer was polished to remove the unwanted CuO layer, and sample cells were tested using simulated solar radiation. Spectral response was also analyzed, as were the effects of oxide thickness and oxidation temperature. Sample cells were also made using a reducing atmosphere, which formed thin copper layers on the Cu/sub 2/O during part of the annealing process, therefore creating Cu/sub 2/O-Cu contacts on all surfaces. Absorption coefficients were measured and photovoltaic performance analyzed; response curves shifted to shorter wavelengths as the thickness of the oxide layer increased. The role of impurities in the photovoltaic effect is also discussed. The work as described in this report seems to indicate that if such research is pursued further, it may lead to achieving good photovoltaic efficiencies using copper oxide as the basic material. 24 refs., 21 figs., 2 tabs.

2911 **(PNL—6726) Low-temperature conversion of high-moisture biomass: Topical report, January 1984--January 1988.** Sealock, L.J. Jr.; Elliott, D.C.; Butner, R.S.; Neuenschwander, G.G. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 121p. NTIS, PC A07/MF A01. Order Number DE89002815/JAW.

Pacific Northwest Laboratory (PNL) is developing a low-temperature, catalytic process that converts high-moisture biomass feedstocks and other wet organic substances to useful gaseous and liquid fuels. The advantage of this process is that it works without the need for drying or dewatering the feedstock. Conventional thermal gasification processes, which require temperatures above 750{degree}C and air or oxygen for combustion to supply reaction heat, generally cannot utilize feedstocks with moisture contents above 50 wt %, as the conversion efficiency is greatly reduced as a result of the drying step. For this reason, anaerobic digestion or other bioconversion processes traditionally have been used for gasification of high-moisture feedstocks. However, these processes suffer from slow reaction rates and incomplete carbon conversion. 50 refs., 21 figs., 22 tabs.

2912 **(SAND—88-0577C) A summary of recent photovoltaic concentrator technology developments.** Boes, E.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 36p. (CONF-880965—18). NTIS, PC A03/MF A01. Order Number DE89001367/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

Development and application of photovoltaic power technologies is rapidly expanding, and there are clear indications that this will continue. This paper discusses the status and potential of the different photovoltaic collector technologies in this changing environment. The primary focus of the paper is on photovoltaic concentrators. The past year has seen a significant increase in research and development of photovoltaic concentrator technology. In all, more than 10 development teams are known to be pursuing PV concentrator technology in the US. Over half of these development efforts have not been reported to date. This paper will summarize these development efforts. It will describe and compare the different designs being developed. It will also discuss the relative advantages and disadvantages of the different designs, both in terms of performance and cost. The developmental status of these projects will also be described, including a summary of available performance information on components and modules. This paper will also described current development efforts on PV concentrator components, including concentrator cells. Fresnel lenses and secondaries, and cell assemblies. With this information, projections for the designs and performance of next generation PV concentrator technology will be presented. 15 refs., 3 tabs.

2913 **(SAND—88-0632C) Recent advances in high-efficiency InGaAs concentrator cells.** Werthen, J.G.; Arau, B.A.; Ford, C.W.; Kaminar, N.R.; Kuryla, M.S.; Ristow, M.L.; Lewis, C.R.; MacMillan, H.F.; Virshup, G.F.; Gee, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 4p. (CONF-880965—21). NTIS, PC A02/MF A01. Order Number DE89001613/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

InGaAs concentrator cells with bandgaps of 1.15 eV and 1.35 eV have been developed. These cells are intended for eventual use in dual- and triple-junction tandem solar cells, respectively. The InGaAs cell structures were grown by MOCVD on GaAs substrates with grading layers to accommodate lattice mismatch. Efficiencies greater than 24% at 400 suns (AM 1.5D, 100 mW/cm^2) have been demonstrated by InGaAs cells with either bandgap. Since the 1.15-eV InGaAs has a bandgap close to silicon, comparison of the photovoltaic effect in materials with direct and indirect bandgaps is possible. The InGaAs demonstrates open-circuit voltage up to 800 mW (130 mW higher than Si) under concentration. Conversely, Si demonstrates a one-sun short-circuit current of 42 mA/cm^2 compared to 31 mA/cm^2 for InGaAs. Possible reasons for the higher voltages will be given, and implications regarding projected tandem cell performance will be discussed. 8 refs., 5 figs., 1 tab.

2914 **(SAND—88-0637C) Electrical fault protection for a large photovoltaic power plant inverter.** Collier, D.E.; Key, T.S. (Sandia National Labs., Albuquerque, NM (USA); Sacramento Municipal Utility District, CA (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-880965—17). NTIS, PC A02/MF A01. Order Number DE89001366/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

Lessons-learned from electrical faults and subsequent fires in the dc wiring of a photovoltaic (PV) power plant have resulted in a more effective fault protection strategy. This paper analyzes the original protection design and describes changes. The zone-of-protection was extended and fault detection and response improved. The results suggest a need for better coordination between dc and ac fault protection philosophies that are commonly applied independently by designers. Design lessons for PV array fault protection are described to assist electrical designers in eliminating fault vulnerabilities from future PV systems. These take into account the unique electrical characteristics of PV generators, including the "dispersed-" rather than "point-source" and the "current-" rather than "voltage-source" nature of the PV array. 3 refs., 12 figs.

2915 **(SAND—88-2498C) Thermal degradation mechanisms in GaAs solar cells with high-temperature contacts.** Tobin, S.P.; Bajgar, C.; Vernon, S.M.; Keavney, C.J.; Chung, M.A.; Ruby, D.S. (Sandia National Labs., Albuquerque, NM (USA); Spire Corp., Bedford, MA (USA); Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-880965—20). NTIS, PC A03/MF A01. Order Number DE89001375/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

This objective of this work was to characterize the thermal stability of GaAs solar cells with high-temperature contacts. High-temperature stability is important for threat environments in space, for compatibility with high-temperature assembly techniques, and for enhanced reliability of cells. Our contact system, described previously, relies on a Pt solid-phase ohmic contact, a TiN barrier layer, and an Au conductor, with contact to a heavily doped p-GaAs contact layer. The behavior of both flat-plate and concentrator cells has been characterized as a function of temperature (400-600{degree}C) and time (5-15 minutes) of the anneal. We find that GaAs cells experience minimal electrical degradation up to 550{degree}C for 5 minutes, or to 490{degree}C for 15 minutes. Increases in the 2kT perimeter dark current are responsible for small decreases in Voc and FF up to these temperatures. At higher temperatures a drastic decrease in efficiency is caused by metallurgical reactions at isolated regions along the grid lines. The reaction, which appears to involve Au-Ga, is initiated at the edges of the grid lines. Away from edges, the contacts are metallurgically stable to at least 600{degree}C. 4 refs., 8 figs., 4 tabs.

2916 **(SAND—88-2549C) The status and prospects of high-efficiency solar cells.** Basore, P.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-8810199—1). NTIS, PC A03/MF A01. Order Number DE89001818/JAW.

From 8. new energy industrial symposium; Tokyo, Japan (20 Oct 1988).

It appears likely that laboratory demonstration of flat-plate modules with 18% efficiency using potentially cost-effective materials and processing will occur in the next 18 months. The initial prototype modules will probably use wafers that have been thinned down from thick starting material. The major remaining technical obstacle will be the mass production and handling of thin material with high yield, be it in the form of thin wafers or thin silicon layers grown on a low-cost substrate. Thin wafers could be obtained directly using sheet-growth techniques, or could be cut from ingots if new slicing technology is developed. Growth on a low-cost substrate makes it easier to process the material without breakage, but also blocks access to the back surface of the cell, making it difficult to obtain the necessary surface passivation at the interface. Within the United States photovoltaic program, the developments described are most likely to occur in the universities, particularly Stanford and the University of New South Wales; or at the national laboratories, particularly Sandia. The subsequent challenge to achieving widespread adoption of the high-efficiency approach will be to successfully transfer the necessary understanding to the photovoltaic industry along with enough proprietary advantage to create a profitable market environment. 4 refs., 4 figs., 1 tab.

2917 **(SAND—88-2624C) Thermally conductive alumina/organic composites for photovoltaic concentrator cell isolation.** Beavis, L.C.; Panitz, J.K.G.; Sharp, D.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-880965—11). NTIS, PC A02/MF A01. Order Number DE89001181/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

Electrophoretically deposited styrene-acrylate films were studied. These yield marginally useful thermal conductivities of 0.1--0.2 watts/meter-Kelvin, but have useful dielectric strengths over 2500 volts for 40 micrometer thick coatings. Thin, 25 micrometer, coatings of anodically grown Al_2O_3 films were also investigated. These films have thermal conductivities of approximately 6--8 watts/meter-Kelvin. Although these Al_2O_3 films have greater thermal conductivity than the polymer films, they exhibit porosity which typically limits their dielectric strength to less than 1000 volts. In the current study we have determined that styrene-acrylate can be electrophoretically deposited in porous anodic aluminum oxide films to form an alumina-organic composite with improved electrical breakdown strengths as well as higher thermal conductivity than styrene-acrylate films. 7 refs., 2 tabs.

2918 **(SAND—88-2832C) Concentrator efficiencies of 29.2% for a GaAs cell and 24.8% for a mounted cell-lens assembly.** Kaminar, N.R.; Liu, D.D.; MacMillan, H.F.; Partain, L.D.; Ristow, M.L.; Virshup, G.F.; Gee, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 4p. (CONF-880965—22). NTIS, PC A02/MF A01. Order Number DE89001612/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

A lens/cell efficiency of 24.8% has been obtained in an outdoor test using a single GaAs cell and a Fresnel lens. This is the highest efficiency ever reported for a lens/cell assembly. During the test, the cell was water cooled to a junction temperature of 45{degree}C and the concentration ratio was 205:1. In a related test, a 29.2% cell efficiency was obtained using a GaAs concentrator cell and an Entech prismatic cover glass designed to reduce the effect of shadowing of the grid lines. This efficiency was measured in the flash tester at Sandia Laboratories. 3 refs., 4 figs.

2919 **(SERI/STR—211-3395) Device physics related to the granular nature of $CuInSe_2$ solar cells: Final subcontract report, 1 April 1986--31 March 1988.** Sites, J.R. (Solar Energy Research Inst., Golden, CO (USA); Colorado State Univ., Fort Collins (USA). Dept. of Physics). Sep 1988. Contract AC02-83CH10093. 32p. NTIS, PC A03/MF A01. Order Number DE89000810/JAW.

This report attempts to integrate our collective knowledge about polycrystalline solar cells. The dominant loss mechanisms for both $CuInSe_2$ and CdTe cells are shown graphically, scaled to their estimated magnitudes. There are major limitations due to polycrystalline related mechanisms such as compensation and recombination, but there are also straightforward efficiency improvements possible through reductions in reflection, window absorption, and series resistance. A physical model for polycrystalline semiconductor diodes is proposed and described in detail. The key features of the model are to restrict most defect states to granular surfaces and to require them to be of such a nature that passivation approaching 100% is practical. The fact that these conditions have been nearly achieved empirically is both the cause of past successes and the hope for future improvements. 16 refs., 11 figs., 3 tabs.

2920 **(SERI/STR—211-3406) Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 2, Annual report, 1 October 1984--30 September 1985.** Delahoy, A.E.; Eser, E.; Kampas, F. (Solar Energy Research Inst., Golden, CO (USA); Chronar Corp., Princeton, NJ (USA)). Sep 1988. Contract AC02-83CH10093. 173p. NTIS, PC A08/MF A01. Order Number DE89000812/JAW.

Kinetics of light-induced degradation and thermal recovery of the photoconductivity in a-Si:H have been investigated. Rate equations for these processes were derived using the principles of reaction rate theory. Both degradation and recovery were found to be thermally activated with activation energies of 0.1eV and 1.35eV, respectively. Experimental results support the bond breaking model for the degradation. Stabilization of broken bonds is achieved by structural relaxation. Thermal recovery proceeds through hydrogen hopping from one dangling bond to another. Experimental evidence suggests the existence of an upper limit in the density of light-induced defects. A microscopic model, consistent with experimental observations, is proposed for the light-induced generation and thermal recovery of defects in a-Si:H. 15 refs., 46 figs., 15 tabs.

2921 **(SERI/STR—211-3414) Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 3 semiannual subcontract report, 1 October 1985--31 March 1986.** Delahoy, A.E.; Eser, E.; Kampas, F. (Solar Energy Research Inst., Golden, CO (USA); Chronar Corp., Princeton, NJ (USA)). Sep 1988. Contract AC02-83CH10093. 72p. NTIS, PC A04/MF A01. Order Number DE89000813/JAW.

This report describes the research conducted during the first half of Phase III of a research program on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells. Important progress toward improving the thermal stability of a-Si:H solar cells and panels was made. A substantial amount of work was also performed in developing granular tin oxide from both tetramethyltin and tin chloride. Two chambers of the multichamber deposition system were made operational. A cell efficiency of 10.8% was achieved through the use of light trapping, improved p-layer control, and a graded affinity transitional i-layer. Cells that improve in efficiency upon light soaking ("inverse Staebler-Wronski" cells) were also prepared. 8 refs., 32 figs., 5 tabs.

2922 **Economic evaluations of multiple rotation SRIC biomass plantations.** Strauss, C.H.; Grado, S.C.; Blankenhorn, P.R.; Bowersox, T.W. (Pennsylvania State Univ., University Park (USA)). *Solar Energy;* **41**: No. 2, 207-214(1988).

A series of short-rotation intensive culture (SRIC) Populus plantations involving four management strategies (control, fertilization, irrigation, and fertilization-irrigation) were evaluated in tandem with alternate harvesting and storage strategies to determine the least cost method for supplying biomass to an ethanol conversion facility. The plantations were based on Populus hybrid NE-388, a tree spacing of 0.6 m x 0.8 m, and a rotation length of four years. First rotation yields from the various strategies ranged from 33 to 42 oven-dry metric tonne per hectare (Mg(OD) ha^{-1}). An average yield increase of 12% was realized from the second rotation coppice plantations. The control strategy had the lowest production costs for the two rotations, averaging \$32 Mg^{-1} (OD). Harvesting and storage requirements nearly doubled the final costs, with the least cost system having an average total cost of \$66 Mg^{-1} (OD). Over 50% of the total cost originated from equipment and material inputs, with labor costs representing nearly 30% of the total and land the final 20%.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 2914, 2916

2923 **(N—88-26402) Advanced photovoltaic power system technology for lunar base applications.** Brinker, D.J.; Flood, D.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 10p. (NASA-TM—100965; E—4258; NAS—1.15:100965; CONF-8804104—). NTIS, PC A02/MF A01.

From NASA symposium on lunar bases and space activities of the 21st century; Houston, TX, USA (5 Apr 1988).

Advanced photovoltaic/electrochemical (batteries or regenerative fuel cells for storage) power system options for a lunar base are discussed and compared. Estimated system masses are compared with those projected for the SP-100 nuclear system. The results of the comparison are quantified in terms of the mass saved in a scenario which assembles the initial base elements in Low Earth Orbit (LEO) and launches from there to the lunar surface. A brief summary is given of advances in photovoltaic/electrochemical power system technologies currently under development in the NASA/OAST program. A description of the planned focussed technology program for surface power in the new Pathfinder initiative is also provided.

2924 **(N—88-28853) Energy storage considerations for a robotic Mars surface sampler.** Odonnell, P.M.; Cataldo, R.L.; Gonzalez-Sanabria, O.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 10p. (NASA-TM—100969; E—4259; NAS—1.15:100969; CONF-8807128—). NTIS, PC A02/MF A01.

From Case for Mars 3 conference; Boulder, CO, USA (18 Jul 1988).

A Mars Rover capable of obtaining surface samples will need a power system for motive power and to power scientific instrumentation. Several different power systems are considered along with a discussion of the location options. The weight and volume advantages of the different systems are described for a particular power profile. The conclusions are that a Mars Rover Sample Return Mission and Extended Mission can be accomplished utilizing photovoltaics and electrochemical storage.

1409 Solar Thermal Utilization

2925 **Thermal performance comparisons for solar hot water systems subjected to various collector and heat exchanger flow rates.** Fanney, A.H.; Klein, S.A. (National Bureau of Standards, Gaithersburg, MD (USA)). *Solar Energy;* **40**: No. 1, 1-11(1988).

The thermal performance of solar domestic hot water (SDHW) systems is influenced by the rate at which heat transfer fluids within the system are circulated. An experimental investigation has been conducted at the National Bureau of Standards to quantitatively evaluate the influence of flow rates, both for SDHW systems that circulate potable water directly through the solar collector array and for systems that employ an external heat exchanger to transfer heat from the solar collector array to the potable water. This article presents data from side-by-side experiments that shows improvements in overall SDHW system performance as a result of lowering the collector fluid flow rate for direct systems utilizing conventional return tubes. Although they are limited to one location, specific system configurations, and time periods, these experimental results support the general conclusions reached in earlier experimental and simulation studies regarding the advantage of reduced collector flow rate. Side-by-side experiments were also performed for SDHW systems in which the tanks were fitted with return tubes designed to reduce internal tank fluid mixing. The results of these experiments show only a small difference in overall performance for the systems operated at conventional and reduced collector flow rates. Side-by-side tests of an indirect SDHW system that employs an external heat exchanger did not show improved performance at reduced tankside flow rates. A simulation study of an indirect SDHW for a range of heat exchanger designs and collector and tankside capacitance rates concluded that an optimum collector-side capacitance rate does not exist and an optimum tankside capacitance rate occurs only for heat exchangers with overall heat transfer coefficients much larger than that used in the experiments. 21 references.

2926 **Analytic model of a passive vapor transport heating system.** Neeper, D.A. (Los Alamos National Lab., NM (USA)). *Solar Energy;* **41**: No. 1, 91-99(1988).

After reviewing passive systems for downward transport of heat, an approximate mathematical model is presented for one par-

ticular system in which refrigerant that is evaporated in a solar collector transports heat to a condenser located at some arbitrary elevation below the collector. The vapor pressure fits the liquid from the condenser to an accumulator above the collector, from which it periodically flows into the collector. It is shown that the maximum energy delivery to the condenser can occur when the accumulator loses a specified amount of energy to the environment. Use of one of the ordinary refrigerants as the working fluid should be appropriate for passive for passive space- or water-heating systems in which the collector can be several meters above the condenser.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 2912, 2918

2927 **(SAND—88-0687C) A performance model for nonuniformly illuminated front-gridded concentrator cells.** Kerschen, K.A.; Basore, P.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-880965—19). NTIS, PC A03/MF A01. Order Number DE89001368/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

The illumination profile produced by Fresnel concentrating PV module optics may deviate dramatically from the uniform illumination conditions under which cell performance is normally measured. Estimating the expected performance of concentrator cells under nonuniform illumination is a challenge that goes beyond simply aggregating the measured performance of cells exposed to a range of uniform illumination conditions. It requires the ability to simulate the nonuniform illumination profile of the module optics and to understand the impact that nonuniform illumination has on the cell's power conversion mechanisms. This paper presents these enhancements to an existing PV concentrator performance model that simulates the performance of front-gridded cells with parallel grid lines operating under expected illumination conditions. The model uses standard test data for a user-selected reference cell to estimate the performance of similar cells with different area, metallization coverage, and illumination profile. It also accommodates the application of a prismatic optical cover to eliminate grid-line obscuration. 5 refs., 8 figs., 3 tabs.

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 2929

1502 Geology And Hydrology Of Geothermal Systems

2928 **(DOE/ER/13410—1) Be in the Salton Sea Geothermal System, California (USA): Salton Sea Scientific Drilling Project, California State 2-14 well: Final report.** Valette-Silver, N.J. (Maryland Univ., College Park (USA). Dept. of Chemistry and Biochemistry). Jun 1988. Contract FG05-85ER13410. 151p. NTIS, PC A08. Order Number DE89002686/JAW.

The Salton Sea Geothermal System lies in the old Colorado River Delta, where sediments have been metamorphosed by hydrothermal processes. Fluids, from well Fee No. 5 and deep hole SSSDP California State 2-14, as well as rocks from the deep hole were studied for ^{10}Be and ^{9}Be. In the solid samples ^{10}Be concentration ranges from 29 to 259 {times} 10^{6} atom/g and ^{9}Be from 0.49 to 2.52 ppM. The ^{10}Be concentration in the geothermal waters ranges from 2 {times} 10^{3} to 2.9 {times} 10^{6} atom/g and ^{9}Be from 0.7 to 16.6 ppB. Compared to the steady-state inventory which represents the quantity of ^{10}Be expected from rain deposition alone ({approximately}1 {times} 10^{12} atom/cm^{2}), the ^{10}Be inventory in the deep core is 3 orders of magnitude higher (>1 {times} 10^{15} atom/cm^{2}). This indicates that most ^{10}Be is inherited and that the sediments hosting the geothermal field down to 3250m are young, less than few million year old. ^{10}Be and ^{9}Be Kds decrease from surface to bottom (3333 to 48 and 727 to 393, respectively) expressing the strong leaching effect of the solid material by the geothermal waters. This process is more active at depth where pH is <5.3 and salinity high (≅25%). Compared to other natural systems, Salton Sea Geothermal fluids are strongly enriched in ^{10}Be and ^{9}Be. Finally, contamination has been observed in the fluids samples and we developed a tool that is helping in detecting which samples are contaminated.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 2929

1509 Geothermal Engineering

2929 **(LA-UR—88-3420) Hot Dry Rock at Fenton Hill, USA.** Hendron, R.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 20p. (CONF-881196—1). NTIS, PC A03/MF A01. Order Number DE89002129/JAW.

From International workshop on hot dry rock: creation and evaluation of geothermal reservoirs; Tsukuba City, Japan (4 Nov 1988).

The Hot Dry Rock Geothermal Energy Project began in the early 1970's with the objective of developing a technology to make economically available the large ubiquitous thermal energy of the upper earth crust. The program, operated by the Los Alamos National Laboratory, has been funded by the Department of Energy (and its predecessors) and for a few years with participation by West Germany and Japan. An energy reservoir was accessed by drilling and hydraulically fracturing in the Precambrian basement rock at Fenton Hill, outside the Valles Caldera of north-central New Mexico. Water was circulated through the reservoir (Phase 1, 1978--1980) producing up to 5 MWt at 132{degree}C. A second (Phase 2) reservoir has been established with a deeper pair of holes and an initial flow test completed producing about 10 MWt at 190{degree}C. These accomplishments have been supported and paralleled by developments in drilling, well completion and instrumentation hardware. Acoustic or microseismic fracture mapping and geochemistry studies in addition to hydraulic and thermal data contribute to reservoir analyses. Studies of some of the estimated 430,000 quads of HDR resources in the United States have been made with special attention focused on sites most advantageous for early development. 17 refs., 3 figs., 1 tab.

1520 Geothermal Data And Theory

2930 **(SAND—88-0271C) Thermal convection with large viscosity variation in an enclosure with localized heating.** Chu, T.Y.; Hickox, C.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-881120—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013366/JAW.

From ASME winter annual meeting; Chicago, IL, USA (28 Nov 1988).

The present study is undertaken in order to gain an understanding of convective transport in a magma chamber. We have chosen to represent the chamber by an enclosure with localized heating from below. Results of both laboratory experiments and computer modeling are reported. The experimental apparatus consists of a transparent enclosure with a square planform. An electrically heated strip, with a width equal to one-fourth of the length of a side of the enclosure, is centered on the lower inside surface of the enclosure. For the experiments reported here, the top of the fluid layer is maintained at a constant temperature and the depth of the layer is equal to the width of the heated strip. The large viscosity variation characteristic of magma convection is simulated by using corn syrup as the working fluid. Measured velocity and temperature distribution as well as overall heat transfer rates are presented. The experiment is numerically simulated through use of a finite element computer program. Numerically predicted streamlines, isotherms, and velocity distributions are presented for the transverse vertical midplane of the enclosure. Good agreement is demonstrated between predictions and measurements. 23 refs., 8 figs., 2 tabs.

17 WIND ENERGY

2931 **(SERI/SP—320-3400) Wind energy technical reading list.** (Solar Energy Research Inst., Golden, CO (USA)). May 1988. Contract AC02-83CH10093. 23p. NTIS, PC A03/MF A01. Order Number DE88001193/JAW.

The Wind Energy Technical Reading List provides a short bibliography of recent technical publications by the US Department of Energy's Laboratories and their subcontractors and other organizations doing wind energy research and development. The list was prepared by the Technical Information Branch and the Wind Research Program at the Solar Energy Research Institute (SERI). It includes journal articles, papers presented in conference proceedings, and technical reports. Readers interested in a more complete bibliography should consult B.L. Burke (1977-1982), Energy From the Wind, Annotated Bibliography, 4 Vols. Publications Department, Engineering Research Center, Colorado State University, Fort Collins, CO 80523.

1706 Wind Energy Engineering

2932 **(FRT—84-R-1420) Study of a wind generator with centrifugationally aspirated thick propellers.** Malavard; Armand; Lemaigne; Longuet. (Fondation Cousteau, 75 - Paris (France)). Jul 1984. 263p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88755295/JAW.

In order to develop a robust, simple but efficient horizontal-axis wind generator, an aerodynamical study have been conducted on thick propellers: as the optimal distribution of circulation all along the blade have to be fairly constant, it was observed that, for very thick propellers, suction at judiciously distributed positions of the extrados, can result in a very promising lift coefficient (fairly 6). The suction is obtained through the centrifugation of the aspirated air, discharged at the blade tip.

2933 **(PB—88-234703/XAB) Description of the handbook for wind-energy production estimates in the Netherlands.** Vermeulen, P.E.J.; Hoogeveen, H.; Leene, J.A. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). 1984. 62p. (REF—84-07603). NTIS, PC E04/MF A01.

A description is given of the recently completed Dutch Handbook for wind energy production estimates. The Handbook compiles information on basic meteorological data such as wind speed statistics from Dutch meteorological stations. In the Handbook calculation procedures are given to account for mesoscale roughness effects on local wind speed statistics. Also, detailed information is given on the flow field downstream of obstacles such as buildings, wind breaks and other wind turbines. When meso-scale effects, together with local wake effects, are taken into account, the local wind speed statistics at hub-height can be calculated. The Handbook describes several methods which use these local wind speed statistics for wind energy production estimates. In the report, the contents of the Handbook are described and some background information is supplied. (Copyright (c) 1984, TNO, The Hague.)

2934 **(PB—88-869466/XAB) Windmill design, development, construction, and performance. November 1982-September 1988 (Citations from FLUIDEX data base). Report for November 1982-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 112p. NTIS PC N01/MF N01.

Supersedes PB—86-856325.

This bibliography contains citations concerning the design, development, construction, and performance of windmills and associated systems, subsystems, and components. Both aerodynamic and structural performance characteristics are discussed. Included are references to siting characteristics, power production and windmill efficiency, and specific system descriptions. (This updated bibliography contains 331 citations, 52 of which are new entries to the previous edition.)

2935 **(PNL-SA—15970) The wind lumps that bump a rotor.** Connell, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 11p. (CONF-880916—3). NTIS, PC A03/MF A01. Order Number DE89001479/JAW.

From 18. national conference of the American Wind Energy Association; Honolulu, HI, USA (19 Sep 1988).

Wind turbines cannot get along without the wind and sometimes they have trouble getting along with it. At the core of the problem is the way turbine rotors interact with turbulence. At the core of the solution is an appreciation for and understanding of the features of turbulence. Turbulent wind is complex. To avoid this complexity when considering the effects of turbulence, it is characterized by statistics that leave most of us with a sense of turbulence being a random set of nearly featureless fluctuations of wind velocity distributed in space and time by some statistical rule. Yet we have personal experience that the wind is filled with eddies or gusts with shapes and sizes that produce a "lumpiness" to the flow of wind that is far from featureless and is not random in all aspects. The purpose of this paper is to make more clear the importance of incorporating the three-dimensional spatial variation of turbulence velocity that is part and parcel of the shape and size of turbulence eddies. 5 refs., 7 figs.

2936 **Primer of turbulence at the wind turbine rotor.** Connell, J.R. (Pacific Northwest Lab., Richland, WA (USA)). *Solar Energy;* **41**: No. 3, 281-293(1988). Contract AC06-76RL01830.

Some wind turbine fatigue problems are caused by the turbulent wind, and there is an engineering need to understand both qualitatively and quantitatively the characteristics of the wind that are causing untimely damage to wind turbine components. To help meet this need, this article describes, in simple terms, turbulent motion: where it is generated and how it changes with differences in terrain, height above the ground, meteorological conditions, time, and distance from its source. For quantitative information on conventional atmospheric turbulence, the reader is referred to the classic literature, and for current information specialized for wind turbine dynamics the reader is guided to the modern literature of the American and European wind energy programs. The article concludes with examples of several computational methods and several measurement methods of modeling the turbulent wind that loads and stresses turbine rotors.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 2773, 2773, 2983, 3040

2937 **(CRIEPI-W—87019) Gas turbine research facility for coal gasification combined cycle power generation system - outline of research facility.** Sato, M. (and others). (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). 1988. vp. (Japanese). Central Research Institute of Electric Power Industry, Tokyo, Japan.

There are three specific features in coal derived gaseous fuel produced by the air blown entrained bed coal gasifier: (1) its calorific value is very low (1000 kcal/m^{3}N); (2) carbon monoxide is the main combustible gas; and (3) ammonia is contained if the gas cleanup system is hot dry type. Development of high temperature gas turbine combustor using coal-derived gaseous fuel has large influence on the success of coal gasification combined cycle power generation system. In our research institute, a Gas Turbine Research Facility for Coal Derived Gaseous Fuel, approximating what we can produce, has been just constructed in order to develop gas turbine technology in the coal gasification combined cycle power generation system. We have a plan to develop a metal gas turbine combustor, a ceramic gas turbine combustor and other research subjects by using this research facility. This report describes the outline of this facility, main specification and results of performance evaluation test.

2938 **(DOE/EA—0369) Power sales and exchange with Puget Sound Power and Light: Environmental Assessment.** (USDOE Bonneville Power Administration, Portland, OR). Oct 1988. 23p. NTIS, PC A03/MF A01. Order Number DE89003014/JAW.

The Bonneville Power Administration (BPA) is proposing to enter into a power sale and exchange contract with Puget Sound Power and Light Company (Puget), a Pacific Northwest investor-owned utility. The contract is for a 20-year term beginning November 1, 1988, and ending March 2, 2008. The contract provides for a power sale of 300 megawatts (MW) of contract demand October 1 through March 31 each year at a 50 percent load factor. Upon conversion of the power sale to a power-for-power exchange, BPA will continue the same power deliveries to Pudget (but less annual energy), and Pudget will deliver to BPA during the period July 1 through October 31 each year amounts of power equivalent to those BPA delivers during a 123 day period beginning November 1. This Environmental Assessment (EA) describes the potential environmental impacts of the proposed power sale and power-for-power exchange between BPA and Puget. 2 figs., 2 tabs.

2939 **(EPRI-AP—6011) A 180-MWe British Gas/Lurgi-based IGCC [integrated gasification combined-cycle] power plant: Feasibility study at Virginia Power and Detroit Edison: Final report.** Booras, G.S.; Pietruszkiewicz, J.; Sibley, F.O. (Electric Power Research Inst., Palo Alto, CA (USA); Bechtel Group, Inc., San Francisco, CA (USA); British Gas plc., London; Virginia Power Co., Richmond (USA); Babcock Woodall-Duckham Ltd., Sussex (UK); Lurgi G.m.b.H., Frankfurt am Main (Germany, F.R.)). Sep 1988. 171p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001764/JAW.

This study investigated the merits of combining the British Gas/Lurgi slagging gasifier (BGL gasifier) with an advanced gas turbine in a 180-MWe, commercial-scale IGCC power plant located at Virginia Power's Chesterfield station. The gasification plant was fed with run-of-mine Pittsburgh No. 8 coal (containing 60 percent fines) and sized to fully load one General Electric MS7001F gas turbine at 88{degree}F ambient temperature. Seventy-five percent of the total coal fines were pelletized by agglomeration prior to gasification. All recovered tars and oils were recycled to the gasifier, while the gas liquor (process wastewater) is completely incinerated. The results of the study indicate that the IGCC power plant has a very good heat rate on coal (8993 Btu/kWh at 59{degree}F and a moderate capital cost, i.e., total capital requirement, on coal ($1910/kW at 59{degree}F, with AFDC) for a commercial-scale plant in this size range. With distillate augmentation to the medium-Btu fuel gas at 59{degree}F, the capital cost drops to about $1770/kW (with AFDC). A sensitivity study compared the cost and performance of a similar IGCC power plant located at an alternate plant site owned by Detroit Edison. The capital cost for the Detroit Edison plant increased by about $200/kW, with a very slight improvement in heat rate. 16 figs., 59 tabs.

2940 **(EPRI-AP—6027) Survey of gasification: Combined-cycle plant site requirements: Final report.** Schmoe, L.A.; Danforth, P.R.; Weekes, M.C. (Electric Power Research Inst., Palo Alto, CA (USA); Bechtel Group, Inc., San Francisco, CA (USA)). Oct 1988. 71p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001765/JAW.

This study surveys a number of recent gasification combined cycle (GCC) plant studies to identify, then quantify, the significant variables affecting GCC plant plot area requirements. A methodology is developed which, with only a minimum of design information, estimates a range of potential plot areas and illustrates the relationships of plot area to the more significant design parameters. The key variables affecting plot area include (in roughly decreasing importance): the site land availability constraints, the plant generating capacity, the use of on-site solid waste disposal, the design coal properties, and the type of coal delivery. Land availability has the largest single effect, with a tightly constrained site requiring as little as one-fourth that of a very open, unconstrained site. Several other factors which have a major influence on the design of a GCC plant, in fact, generally have little impact on plot area. These include the particular gasification process used, the type of cooling system, and the plant heat rate. 26 figs.

2941 **(PNL-SA—16191) Contact charging electrically enhanced fluidized bed heat exchanger for energy recovery from gas streams.** Lessor, D.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 13p. (CONF-881033—1). NTIS, PC A03/MF A01. Order Number DE89001477/JAW.

From International congress on technology and technology exchange; Pittsburgh, PA, USA (18 Oct 1988).

Good energy extraction from hot gas flow streams can be obtained using a fluidized bed of two species of triboelectrically different particles and applying a low-frequency potential difference between alternate tubes or between tubes and interspersed rods. Higher heat transfer coefficients should allow more compact equipment, lower gas-to-secondary fluid temperature differences, and better energy recovery. 7 refs., 3 figs., 2 tabs.

2002 Environmental Control Technology

2942 **(PB—88-244447/XAB) Ohio/Kentucky/TVA (Tennessee Valley Authority) coal-fired utility SO_2 and NOx control retrofit study. Final report, October 1985-September 1987.** Emmel, T.E.; Piccot, S.D.; Laseke, B.A. (Radian Corp., Research Triangle Park, NC (USA)). Aug 1988. 531p. NTIS, PC A23/MF A01.

This report documents initial results from an ongoing National Acid Precipitation Assessment Program (NAPAP) study. The objective is to significantly improve engineering cost estimates for retrofit of the following control technologies at the 1980 top 200 SO_2-emitting coal-fired power plants in the 31 eastern states: lime/limestone FGD, lime spray drying FGD, coal switching and cleaning, furnace sorbent injection with humidification (LIMB), duct sorbent injection, low-NOx burners, overfire air, natural gas reburn, and selective catalytic reduction. Retrofit cost factors and costs were developed for 12 coal-fired power plants: 5 in Ohio and 7 in Kentucky and the TVA system (Tennessee, parts of Alabama, and Kentucky). Activities included: selecting plants with boilers representative of the top 200 population; visitng plants and collecting site-specific data.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 2938

2943 **Transformer coupling for transmitting direct current through a barrier.** Brown, R.L.; Guilford, R.P.; Stichman, J. (to Dept. of Energy, Washington, DC). US Patent 4,761,724. 2 Aug 1988. Filed date 29 Jun 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A system is described for transmitting direct current across a mechanical and electrical barrier from an energy source on a first side of the barrier to a load on a second side of the barrier. The system consists of: transformer means comprising a primary core disposed on the first side of the barrier, a secondary core disposed in alignment with the primary core on the second side of the barrier, a primary winding on the primary core for applying oscillating current thereto, and a secondary winding on the secondary core for applying transmitted energy to the load; means for converting direct current from the direct current energy source into oscillating current for application to the primary winding; means for converting alternating current from the secondary winding to direct current; optical link means for optically coupling the oscillating circuit to the secondary winding for regulating voltage on the secondary winding; and mechanical magnetic coupling means selectively movable between a first position and a second position, energy being transmitted from the primary core to the secondary core only when the magnetic coupling means is in the first position.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 3161

2944 **(CEGB-TPRD/L—3301/R88) Behavioural basis of fish exclusion from coastal power station cooling water intakes.** Turnpenny, A.W.H. (CERL Marine Biology Unit, Fawley (GB)). (Central Electricity Research Labs., Leatherhead (UK)). Aug 1988. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755480/JAW.

The first principles of fish behaviour in flow fields, and why fish enter water intakes are considered, together with how they can best be excluded. Possible solutions are discussed where fish exclusion is a priority but the ability of fish to detect intakes is likely to be poor due to high turbidity. These involve the use of sound, light or hydraulic stimuli. However, results are likely to be site-specific and field trials would be required. The fish-attractant properties of offshore intake structures are considered. Designers of many existing intake structures have unwittingly incorporated features which are now recognized as fish attractants, in particular, open steelwork superstructures and boulder rip-rap. Such features can be expected to add to the problem of fish ingress.

2945 **(EPRI-NP—5653-Vol.1) Guidelines for the content of records to support nuclear power plant operation, maintenance, and modification (NCIG-08): Volume 1, Guidelines: Final report.** Reedy, R.F.; Hegglin, D.P. (Electric Power Research Inst., Palo Alto, CA (USA); Reedy Associates, Inc., Los Gatos, CA (USA)). Nov 1988. 45p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002748/JAW.

The record systems at many nuclear power plant sites are becoming overloaded with unnecessary and superfluous records. The reason for this overload is that although the Codes and Standards list the record types to be retained, there is no definition for the contents of the records. This encourages varied interpretations which often lead to the approach of "save everything". This document provides guidelines for the content of records to support nuclear power plant operation, maintenance and modification. These Guidelines are based on an engineering approach to identify which data in the records are of "significant value" in (1) demonstrating capability for safe operation; (2) maintaining, reworking, repairing, replacing, or modifying an item; (3) determining the cause of an accident or malfunction of an item; and (4) providing required baseline data for in-service inspection. Particular topical issues affecting record retention needs, such as plant life extension activities, may require additional evaluation of data or records. By identifying the data to be retained in the records, it is possible to modify the record management system to substantially reduce the amount of unnecessary information being retained in the records. These Guidelines will provide for more uniform interpretation of requirements. The Guidelines are meant as an interpretation of current Codes, Standards and Regulatory Guides, and not as new requirements. Should any conflict exist between these Guidelines and the specified requirements of the NRC Regulations, the regulations govern. 4 tabs.

2946 **(NUREG—0020-Vol.12-No.10) Licensed operating reactors: Status summary report, data as of September 30, 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Oct 1988. 559p. NTIS, PC A24/MF A01 - GPO. Order Number TI89002702/JAW.

The US Nuclear Regulatory Commission's monthly Licensed Operating Reactors Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Information Resources Management, from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. Since all of the data concerning operation of the units is provided by the utility operators less than two weeks after the end of the month, necessary corrections to published information are shown on the Errata page. This report is divided into three sections: the first, contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

2947 **(NUREG—1272-Vol.2-No.1) Report to the US Nuclear Regulatory Commission on analysis and evaluation of operational data - 1987: Power reactors.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Oct 1988. 214p. NTIS, PC A10/MF A01 - GPO. Order Number TI89001370/JAW.

This annual report of the US Nuclear Regulatory Commission's Office for Analysis and Evaluation of Operational Data (AEOD) is devoted to the activities performed during 1987. The report is published in two volumes. NUREG-1272, Vol. 2, No. 1, covers Power Reactors and presents an overview of the operating experience of the nuclear power industry, with comments regarding the trends of some key performance measures. The report also includes the principal findings and issues identified in AEOD studies over the past year, and summarizes information from Licensee Event Reports, the NRC's Operations Center, and Diagnostic Evaluations. NUREG-1272, Vol. 2, No. 2, covers Nonreactors and presents a review of the nonreactors events and misadministration reports that were reported in 1987 and a brief synopsis of AEOD studies published in 1987. Each volume contains a list of the AEOD Reports issued for 1980-1987.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 2959, 2962, 3007, 3013, 3019, 3027, 3030, 3033, 3034, 3039

2948 **(EPRI-NP—5836M) BWR pilot plant life extension study at the Monticello plant: Interim Phase 2.** Bailey, T.L.; Musolf, D.M. (Electric Power Research Inst., Palo Alto, CA (USA); Northern States Power Co., Minneapolis, MN (USA)). Oct 1988. 296p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002431/JAW.

The Monticello BWR Pilot Plant Life Extension Program was initiated in 1985 to examine in some detail the technical and economic viability of life extension for an operating nuclear power plant. The scope of the Phase 1 study was the identification, importance ranking and life assessment of the critical plant components. Results of this initial phase were reported in EPRI Report NP-5181 and provided the basic encouragement to embark on a generic effort and formulation of the Nuclear Utility Plant Life Extension Program (NUPLEX). The Phase 1 conclusions, based on the initial 27 critical component assessments, contained a number of qualifiers and assumptions with respect to the remaining plant components. To verify the earlier assumptions and to expand the technical bases for a planned future license renewal process, the scope of the Phase 2 program was chosen to include evaluation of essentially all remaining plant components and structures and to supplement the technical assessments with in-plant inspections and component condition assessments. In the course of the Phase 2 assessments, the maintenance aspect of life extension was evaluated and a comprehensive listing was developed of anticipated or recommended life extension activities. Even though the evaluations were limited to the Monticello unique components and operating history, the plant is substantially generic and representative of many other operating BWR's, such that a significant value can be derived in the planning phase for other similar plants wishing to commence with longer term preparation for license renewal. 2 refs., 15 figs., 36 tabs.

2949 **(EPRI-NP—6023) Chemical decontamination experience at Commonwealth Edison nuclear power plants: Final report.** Beaman, T.A.; Smee, J.L. (Electric Power Research Inst., Palo Alto, CA (USA); Niagara Technical Consultants, Niagara Falls, NY (USA)). Sep 1988. 52p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002436/JAW.

A total of 23 dilute chemical decontaminations and one full system decontamination using a concentrated solvent have been performed at Commonwealth Edison's BWR nuclear stations since 1983. Systems that have been decontaminated include the reactor recirculation system, the reactor water cleanup system, a fuel pool cleanup system, and two isolated fuel assemblies. As a result, CECo has gained a considerable amount of experience and insight as to how decontaminations are best performed, and the results that can be expected. This experience is presented in this report, mainly from the point of view of a recirculation system decontamination. Information on 23 separate topics is presented under the general headings of administrative, chemical, and engineering aspects of decontamination. Some of the specific items discussed include: bid specification and evaluation, critical path time, utility support personnel, recontamination, the effect of hydrogen water chemistry, the effectiveness of repetitive decontaminations, corrosion, equipment, drawings, procedures, operations and waste handling. A brief review of the recent LOMI decontamination at the LaSalle station is presented. This was CECo's first experience with decontamination of a BWR recirculation system that did not have a cross-tie valve in the ring header. 20 refs., 2 figs., 3 tabs.

2950 **(EPRI-NP—6028M) Stress corrosion monitoring and component life prediction: Feasibility study: Final report.** Andresen, P.L.; Coffin, L.F.; Ford, F.P. (Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., Schenectady, NY (USA)). Oct 1988. 52p. Research Reports Center, Box 50490, Palo Alto, CA 94303.. Order Number TI89002437/JAW.

This report describes an investigation of a new life prediction concept entitled "Smart Monitor/Smart Life Production." The concept contains three essential elements in optimizing of the on-line performance of plant components: (1) a monitor or monitors to measure the instantaneous damage rate and cumulative damage to the monitor from stress corrosion cracking, (2) a life prediction model that interprets the state of the damage monitor using monitor design characteristics and nominal or measured water chemistry parameters, and then relates this to that of other components and predicts the consequences both currently and for the future, and (3) recommended actions related to changes in plant operation. These elements are envisaged to be integrated so that the damage state is known at all times, and action can always be made in response to that damage state. This study was designed to demonstrate the feasibility of combining several technologies developed recently. These include stress corrosion monitor concepts, techniques for monitoring crack growth in damage monitors and plant components (tests were performed on 4-inch type-304 stainless steel pipes); a high-temperature electrochemical potential monitor designed to operate for extended periods in high-temperature water; and a subcritical cracking model valid for stainless steels in water of varying dissolved oxygen content and solution conductivity. The integration of these techniques is done in a series of steps of increasing experimental complexity leading finally to the comparison of measurement and prediction of the environmentally controlled cracking rate of a sensitized stainless steel pipe. This work constitutes a successful laboratory demonstration of the feasibility of an on-line monitor and a life prediction concept which can assess the life performance of operating plant components. 22 refs., 24 figs., 4 tabs.

2951 **(IEN-DERE-DIFIR—16/87) Implementation of CP1 computer code in the Honeywell Bull computer in Brazilian Nuclear Energy Commission (CNEN).** Couto, R.T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 28 Oct 1987. 44p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704245/JAW.

The implementation of the CP1 computer code in the Honeywell Bull computer in Brazilian Nuclear Energy Comission is presented. CP1 is a computer code used to solve the equations of punctual kinetic with Doppler feed back from the system temperature variation based on the Newton refrigeration equation (E.G.).

2952 (INIS-SU—55, pp 3-8) **Computer-aided design of nuclear reactors.** Mitenkov, F.M.; Karabasov, A.S.; Mikishev, V.V.; Ryabinin, V.P.; Samojlov, O.B. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Peculiarities of creation of the computer-aided design systems (CADS) for water-cooled and moderated nuclear reactors are considered. A system analysis approach to the given CADS development on the basis of subdividing the design information into types (control, numerical, graphic) and subtypes depending on the degree of their effects on the reactor characteristics is described. A method of CADS construction for initial design stages, based on using the local graphs of controlling parameter is proposed. Description of data base and software structure is given. 4 refs.; 4 figs.

2953 **(NUREG/CR—5133) A computational model for critical flow through intergranular stress corrosion cracks.** Schrock, V.E.; Revankar, S.T.; Lee, S.Y.; Wang, C.H. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Lawrence Berkeley Lab., CA (USA)). Nov 1988. Contract AC03-76SF00098. 101p. (LBL—21967). NTIS, PC A06/MF A01 - GPO. Order Number TI89003020/JAW.

The presence of intergranular stress corrosion cracks (IGSCC) in thermal stressed zones in stainless steel piping and associated components is of much concern in reactor safety. The prediction of leak rates through the cracks is important in assessing the plant reliability. An analytical model has been developed to predict flow rates of initially subcooled or saturated water through these cracks. The model assumes the flow in the crack to be homogeneous and in thermal equilibrium. The crack geometry was idealized as a convergent straight slit of constant gap thickness. The fluid is assumed to enter the crack without separation. The one dimensional model accounts for the changing cross sectional area in the flow direction. The effects of wall friction, expansions/contractions and tortuosity of the actual flow path are lumped into an equivalent friction. The numerical scheme developed for the model solution has been programed into a Fortran computer code called SOURCE. A companion subroutine STEAM provides the saturated fluid properties. Inputs to SOURCE are the upstream stagnation pressure and temperature, the crack geometry specification, and the equivalent friction factor. SOURCE has been assessed against the experimental data obtained in the Battelle Columbus Laboratories (BCL) study using actual crack specimens. From a parametric study of the BCL data using SOURCE, a subcooling correction factor was developed to modify source predictions. A general methodology was developed for predicting a lumped friction factor (includes effects of bends, contractions and expansions) for use in SOURCE. Corrected SOURCE predictions using the general friction factor methodology agree well with BCL data. This method is recommended for estimating leak rates and assessing the leak-before-break criterion. 18 refs., 7 figs., 5 tabs.

2954 **(NUREG/CR—5140) Value-Impact Analysis for extension of NRC Bulletin 85-03 to cover all safety-related MOVs.** Higgins, J.C.; Ruger, C.J.; MacDougall, E.A.; Huszagh, D. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 94p. (BNL-NUREG—52145). NTIS, PC A05/MF A01 - GPO. Order Number TI89002936/JAW.

Bulletin 85-03 is entitled Motor-Operated Valve (MOV) Common Mode Failures During Plant Transients Due to Improper Switch Settings. The Bulletin requires that NRC licensees implement a detailed program to ensure that MOV operator switch settings are set properly in two particular safety-related systems per operating nuclear power plant. The proposal analyzed herein requires licensees to extend this detailed program to ensure proper MOV switch settings for all safety-related MOVs. A Value-Impact Analysis was performed, according to the guidelines in NUREG/CR-3568, "A Handbook for Value-Impact Assessment," to determine the cost effectiveness of extending NRC Bulletin 85-03, consistent with providing protection of the public health and safety, to cover all safety-related MOVs. The results show that both a very favorable dose aversion and dollar savings can be realized if the proposed actions are implemented. Also, the proposed actions can be justified based on existing requirements. 37 refs., 5 figs., 12 tabs.

2955 (NUREG/CR—5201) Experimental assessments of Gundremmingen RPV archive material for fluence rate effects studies. Hawthorne, J.R.; Hiser, A.L. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA)). Oct 1988. 312p. (MEA—2286). NTIS, PC A14/MF A01 - GPO. Order Number TI89001988/JAW.

The 250-MW boiling water Gundremmingen reactor, KRB-A, in the Federal Republic of Germany (FRG) has been decommissioned by the utility owners. A joint USA/FRG/UK study, conceived by the US Nuclear Regulatory Commission (NRC), is underway to evaluate material removed from the vessel by trepanning for a critical assessment of power reactor vs. test reactor environment effects. MEA, Staatliche Material Pruefungsanstalt (MPA), and UKAEA-Harwell are responsible for the experimental phases of the joint program. The reactor vessel operated at {approximately}288{degree}C; the inner wall fluence estimate at the time of decommissioning was about 1 {times} 10^{19} n/cm^2, E > 1 MeV. This report describes irradiation assessments of a welded forging segment believed to be archive material from the KRB-A vessel fabrication. Preirradiation verification tests of the material are also summarized. Charpy-V (C/sub v/), compact tension (CT) and tension test specimens were irradiated in the 2-MW light water-cooled test reactor located at the Buffalo Materials Research Center. Five as-irradiated conditions and two postirradiation annealed conditions were evaluated. With 288{degree}C irradiations, the elevation in 100 MPa$\sqrt{m}$ temperature from fracture mechanics tests was found to match the elevation in 41-J temperature from C/sub v/ tests within 12{degree}C. The latter elevation was predicted well by NRC's Regulatory Guide 1.99. The L-C orientation for the archive material vs. the vessel trepans suggest a fluence-rate effect. The C-L orientation data, however, do not. A test orientation dependence of radiation embrittlement sensitivity, described by the trepan material but not the archive material, is responsible and is anomalous. 15 refs., 33 figs., 6 tabs.

2956 (WHC-SA—0289) A laboratory method to predict hydriding properties of zirconium alloys under irradiation. Johnson, A.B. Jr.; Levy, I.S.; Lanning, D.D.; Gerber, F.S.; Trimble, D.J. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1988. Contract AC06-87RL10930. 25p. (CONF-880696—2). NTIS, PC A03/MF A01. Order Number DE89001916/JAW.

From 8. international conference on zirconium in the nuclear industry; San Diego, CA, USA (18 Jun 1988).

A corrosion and hydriding test series on zirconium alloys in the Engineering Test Reactor G-7 loop demonstrated relatively large lot-to-lot and alloy-to-alloy differences in hydriding rates under irradiation. Similar differences were also found among irradiated Zircaloy-2 pressure tubes fabricated by three suppliers for the Hanford Site N Reactor. This substantial in-reactor hydriding data base and access to archive materials from these alloys permitted an investigation of methods to reproduce the in-reactor hydriding orders-of-merit by an out-of-reactor method. The out-of-reactor method selected for investigation consisted of autoclaving alloys in relatively concentrated (0.3 to 1.0M) aqueous lithium hydroxide solutions. The test times ranged from 7 to 35 d, and the samples were held at constant temperatures within the water reactor coolant temperature range (280{degree}C to 315{degree}C). The in-reactor hydriding behavior for several lots of Zircaloy-2, one lot of Zircaloy-4, and one lot of Zr--2.5Nb was reproduced in the lithium hydroxide tests. The hydriding rates were compared on the basis of the ratio of hydrogen weight gain to oxide weight gain. 13 refs., 4 figs., 6 tabs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 2952, 2953, 2954, 2956, 2979, 2982, 3004, 3005, 3007, 3008, 3010, 3011, 3014, 3017, 3018, 3019, 3026, 3027, 3030, 3033, 3034, 3035, 3036, 3198

2957 (DOE/NE—0084) VVER, water moderated energy reactor: Overall plant design description. (USDOE Assistant Secretary for Nuclear Energy, Washington, DC). May 1987. 233p. NTIS (US Sales Only), PC A11; GPO Dep. Order Number DE88006565/JAW.

The United States Department of Energy is compiling information to better understand Soviet nuclear power plants. This report provides information concerning the VVER, the Soviet designed pressurized water reactor. The information in this report is based on published information concerning VVERs, technical information presented at professional meetings, and on information provided by experts. This report is written for a technical audience and assumes a knowledge of the designs, practices, codes, standards, and safety regulations used in the United States. Comparisons and judgments concerning institutional and technical differences between nuclear power plants in the United States and VVERs are avoided.

2958 (DOE/NE/37970—T6) Use of the modular modeling system in the design of the Penn State Advanced Light Water Reactor. Smith, K.A. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering). Dec 1988. Contract AC02-86NE37970. 85p. NTIS, PC A05/MF A01. Order Number TI89001868/JAW.

This study involves the design and subsequent transient analysis of the Penn State Advanced Light Water Reactor (PSU ALWR). The performance of the PSU ALWR is evaluated during small step changes in power and a turbine trip from full power without scram. The Modular Modeling System (MMS), developed by Babcock and Wilcox under a contract from the Electric Power Research Institute (EPRI), is a computer code designed for the simulation of nuclear and fossil power plants. MMS uses preprogrammed modules to represent specific power plant components such as pipes, pumps, steam generators, and a nuclear reactor. These components can then be connected in any manner the user desires providing certain simple interconnection rules are followed. In this study, MMS is used to develop computer models of both the PSU ALWR and a conventional PWR operating at the same power level. These models are then subjected to the transients mentioned above to evaluate the ability of the letdown-injection system to maintain primary system pressure. The transient response of the PSU ALWR and conventional PWR MMS models were compared to each other and whenever possible to actual plant transient data. 14 refs., 29 figs., 5 tabs.

2959 (EPRI-NP—5987M) 1987 EPRI workshop on mechanisms of primary water intergranular stress corrosion cracking: Proceedings. Gorman, J.A.; Partridge, M.J. (Electric Power Research Inst., Palo Alto, CA (USA); Dominion Engineering, Inc., McLean, VA (USA)). Sep 1988. 70p. (CONF-8704330—Summs.). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88017205/JAW.

From EPRI workshop on mechanisms of primary water intergranular stress corrosion cracking; Alexandria, VA, USA (29 Apr 1987).

A meeting on "Mechanisms of Primary Water IGSCC" (PWSCC) was organized to give those working in this area an opportunity to share their results, ideas, and plans in regard to investigations of fundamental aspects of the PWSCC phenomenon affecting alloy 600 steam generator tubes. Topics discussed included: (1) General reviews of hydrogen embrittlement and film rupture - anodic dissolution mechanisms of stress corrosion cracking, (2) environmental factors involved in PWSCC, (3) the influence of microstructure on PWSCC, and (4) the influence of stress and plastic strain on PWSCC. A significant portion of the discussions of all of these topics was devoted to the subject of modelling of crack initiation and crack growth.

2960 (EUR—6540) Elaboration of a guideline for counterpart testing of integral loop systems. Karwat, H. (Technische Univ. Muenchen (DE). Lehrstuhl fuer Reaktordynamik und Reaktorsicherheit). (Commission of the European Communities, Luxembourg). 1988. 112p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755641/JAW.

A previous study on the problems of scaling and extrapolation of experimental results indicated the necessity to overcome some uncertainty in the achievable code accuracy when applied to full size reactor systems. The empirical approach in simulating interfacial relationships within systems behaviour codes in combina-

tion with the liberty of nodalisation requires a careful assessment of the overall validity of the code verification concept. Several new test facilities are presently under construction to study fluid-dynamic effects of interest for the behaviour of PWRs under small break LOCA conditions in a larger dimension and with somewhat modified scaling considerations. The test results expected from these new facilities may be useful to assess the overall validity of the analytical simulation concept of the applied computer codes. Test facilities of interest within the European Community are the - LOBI Test Facility (vol. scaling 1/700) at JRC-Ispra - SPES Test Facility (vol. scaling 1/425) in Italy - BETHSY Facility (vol scaling 1/100) in France and outside Europe the - ROSA IV Facility (vol. scaling 1/50) in Japan. Main objective of the study was the elaboration of a guideline for the particular requirements of meaningful counterpart testing with the final aim to qualify the overall validity of code simulation concepts and the expected predictive accuracy of code applications for full size prototype PWRs.

2961 **(FRNC-TH—3381) Calculation qualitication of gadolinium burnable poisons in water reactors.** Chaucheprat, P. (Paris-11 Univ., 91 - Orsay (France)). 21 Apr 1988. 382p. (In French). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755657/JAW.

The work presented in this thesis constitutes the qualification on the one end of Appolo-Neptune scheme for the gadolinium burnable poison in a pressurized water reactor, and on the other end of basis nuclear data on natural gadolinium. This study has permitted to reduce by a factor 3 the actual incertitude on the gadolinium poison comparatively at precisions cited in international benchmarks calculations.

2962 **(NUREG/CR—5220-Vol.2) Diagnosis of condensation-induced waterhammer: Case studies.** Izenson, M.G.; Rothe, P.H.; Wallis, G.B. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Creare, Inc., Hanover, NH (USA)). Oct 1988. 137p. (CREARE-TM—1189-Vol.2). NTIS, PC A07/MF A01 - GPO. Order Number TI89002153/JAW.

This guidebook provides reference material and diagnostic procedures concerning condensation-induced waterhammer in nuclear power plants. Condensation-induced waterhammer is the most damaging form of waterhammer, and its diagnosis is complicated by the complex nature of the underlying phenomena. In Volume 1, the guidebook groups condensation-induced waterhammers into five event classes which have similar phenomena and levels of damage. Diagnostic guidelines focus on locating the event center where condensation and slug acceleration take place. Diagnosis is described in three stages: an initial assessment, detailed evaluation and final confirmation. Graphical scoping analyses are provided to evaluate whether an event from one of the event classes could have occurred at the event center. Examples are provided for each type of waterhammer. Special instructions are provided for walking down damaged piping and evaluating damage due to waterhammer. To illustrate the diagnostic methods and document past experience, six case studies have been compiled in Volume 2. These case studies, based on actual condensation-induced waterhammer events at nuclear plants, present detailed data and work through the event diagnosis using the tools introduced in the first volume. 20 refs., 21 figs., 6 tabs.

2963 **(EPRI-NP—4574-CCM-Pt.2-Ch.11-Vol.2) ARMP-02 documentation: Part 2, Chapter 11: NODE-P2 computer code manuals: Volume 2: User's manual.** Mosteller, R.D. (Electric Power Research Inst., Palo Alto, CA (USA); Levy (S.), Inc., Campbell, CA (USA)). Oct 1988. 204p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002060/JAW.

NODE-P2 is a core-simulator code for pressurized water reactors. It performs three-dimensional calculations of core behavior at normal steady-state conditions based upon a one-energy-group model. It can perform step-wise macroscopic depletion calculations for the core, but Iodine-135 and Xenon-135 are the only isotopes whose behavior it accounts for explicitly. It also can generate data files whose contents can be processed, directly or indirectly, into physics parameters for input to kinetics codes. 8 refs., 7 figs., 18 tabs.

2964 **(ORNL/tr—88/33) Monitoring irradiation effects on French PWR vessels.** Brillaud, C.; Hedin, F.; Houssin, B. (Electricite de France, Avoine; Electricite de France, 69 - Villeurbanne; Framatome, 92 - Paris La Defense (France)). 1988. Contract AC05-84OR21400. Translated from IAEA-SM-295/12. 21p. NTIS, PC A03/MF A01. Order Number DE89002165/JAW.

At the end of 1986, thirty-three 900 MW PWR units and nine 1300 MW units are in service. In application of regulations, a program to monitor the effects of irradiation on vessel materials is being performed. It involves the base metal, the heat affected zones (HAZ) and the welds. The contents of embrittling elements are low: 0.08% copper to 0.011% phosphorous maximum, except for the welds of the six oldest vessels, where copper reaches 0.13%. The results obtained to the present are presented in the RTNDT differences. The fluences recorded reach 1.5 {times} 10^{19} n {center←dot} cm/sup {minus}2/ E > 1 MeV on specimens removed after four years, which corresponds to approximateiy 12 years of operation, considering the multiplying factor of flux. The average and upper values of difference of the RTNDT are respectively 20{degree}C and 40{degree}C and there is no notable difference between the base metal and the welds. The results obtained are compared with the indications of the various forecasting formulas, specifically with those of a new formula that has been established. 3 refs., 2 figs., 5 tabs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 2824, 2837, 2861, 2862, 2863, 2864, 2865, 2987, 2988, 2997, 3004, 3006, 3020

2965 (INIS-SU—55, pp 43-45) **Effect of initial data errors on the accuracy of calculation of power distributions in reactors of the Bilibino heat and electric power nuclear plant.** Akimov, I.S.; Tukhvetov, F.T. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Effect of burnup account for control rods and in core neutron flux detector emitters as well as the differences in fuel enrichment and loading over a fuel assembly on the accuracy of the Bilibino heat and electric power NPP reactor fuel assembly capacity determination is investigated. A modified method for determining fuel assembly capacity, based on two-dimensional physical calculation correction according to in core detector indications is proposed. 5 refs.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 2812, 2818, 2990, 2992, 3002, 3021, 3022, 3023, 3037, 3339

2966 **(CTA-IEAV-RP—005/88) Optimization of the binary breeder reactor. VIII annular core fueled with /sup 233/U - /sup 238/U and Pu-/sup 238/U.** Nascimento, J.A. do; Ishiguro, Y. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Apr 1988. 48p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704172/JAW.

First cycle burnup characteristics of a 1200 MWe binary breeder reactor with annular core fueled with metallic /sup 233/U-/sup 238/U-Zr, Pu-/sup 238/U-Zr and Th in the blankets have been analysed. The Doppler effect is small as expected in a metal fueled fast reactor. The sodium void reactivity is, in general, smaller than in metal fueled homogeneous fast reactors of 1 m core height. The estimates of the required and available control rod worths show a large shutdown margin throughout the operational cycle. There are flexibilities in the blanket fueling and well balanced breeding in the two cycles, uranium and thorium, with doubling times of about 20 years are possible.

2967 **(EUR—11369) Application of the random vibration approach in the seismic analysis of LMFBR structures.** Preumont, A. (Societe Belge pour l'Industrie Nucleaire, Brussels). (Commission of the European Communities, Luxembourg). 1988. 158p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755653/JAW.

The first part discusses the general topic of the spectral analysis of linear multi-degree-of-freedom structure subjected to a stationary random field. Particular attention is given to structures with non-classical damping and hereditary characteristics. The method is implemented in the computer programme RANDOM. Next, the same concepts are applied to multi-supported structures subjected to a stationary seismic excitation. The method is implemented in the computer programme SEISME. Two related problems are dealt with in the next two chapters: (i) the relation between the input of the random vibration analysis and the traditional ground motion specification for seismic analysis (the Design Response Spectra) and (ii) the application of random vibration techniques to the direct generation of floor response spectra. Finally the problem of extracting information from costly time history analyses is addressed. This study has mainly been concerned with the methodology and the development of appropriate softwares. Some qualitative conclusions have been drawn regarding the expected benefit of the approach. They have been judged promising enough to motivate a benchmark exercise. Specifically, the random vibration approach will be compared to the current approximate methods (response spectrum) and time-history analyses (considered as representative of the true response) for a set of typical structures. The hope is that some of the flaws of the current approximate methods can be removed.

2968 **(PNL-SA—15346) Breached fuel pin contamination from Run Beyond Cladding Breach (RBCB) tests in EBR-II.** Colburn, R.P.; Strain, R.V.; Lambert, J.D.B.; Ukai, S.; Shibahara, I. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 12p. (CONF-881009—3). NTIS, PC A03/MF A01. Order Number DE89001476/JAW.

From 4. international conference on liquid metal engineering and technology; Avignon, France (17 Oct 1988).

Studies indicate there may be a large economic incentive to permit some continued reactor operation with breached fuel pin cladding. A major concern for this type of operation is the potential spread of contamination in the primary coolant system and its impact on plant maintenance. A study of the release and transport of contamination from naturally breached mixed oxide Liquid Metal Reactor (LMR) fuel pins was performed as part of the US Department of Energy/Power Reactor and Nuclear Fuel Development Corporation (DOE/PNC) Run Beyond Cladding Breach (RBCB) Program at EBR-II. The measurements were made using the Breached Fuel Test Facility (BFTF) at EBR-II with replaceable deposition samplers located approximately 1.5 meters from the breached fuel test assemblies. The effluent from the test assemblies containing the breached fuel pins was routed up through the samplers and past dedicated instrumentation in the BFTF before mixing with the main coolant flow stream. This paper discusses the first three contamination tests in this program. 2 refs., 5 figs., 2 tabs.

2969 **(WHC-SA—0286) Fast Flux Test Facility (FFTF) feedback reactivity components.** Nguyen, D.H. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 9p. (CONF-880506—26). NTIS, PC A02/MF A01. Order Number DE89001108/JAW.

From Safety of next generation power reactors; Seattle, WA, USA (1 May 1988).

The static tests conducted during Cycle 8A (1986) of the FFTF have allowed, for the first time, the experimental determination of each of the feedback reactivities caused by the following mechanisms: fuel axial expansion, control rod repositioning, core radial expansion, and subassembly bowing. A semiempirical equation was obtained to describe each of these feedback components that depended only on the relevant reactor temperature (bowing was presented in a tabular form). The Doppler and sodium density reactivities were calculated using existing mechanistic methods. Although they could also be fitted with closed-form equations depending only on temperatures, these equations are not needed in transient analyses using whole core safety computer codes, which use mechanistic methods. The static feedback reactivity model was extended to obtain a dynamic model via the concept of "time constants." Besides being used for transient analyses in the FFTF, these feedback equations constitute a database for the validation and/or calibration of mechanistic feedback reactivity models. 2 refs., 6 tabs.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 2923

2970 **(N—88-28090) Comparative analysis of the space power architecture studies.** Sovie, R.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 15p. (NASA-TM—100977; E—4268; NAS—1.15:100977; CONF-880702—). NTIS, PC A03/MF A01.

From 23. intersociety energy conversion engineering conference; Denver, CO, USA (31 Jul 1988).

The Strategic Defense Initiative Organization (SDIO) has recently completed the initial phase of Space Power Architecture Studies (SPAS). The initial effort consisted of three major contracted efforts and a comparative analysis performed by the SDIO Independent Evaluation Group (IEG) and the IEG Field Support Team. The purpose of the SPAS effort was to evaluate a wide range of power systems for SDIO applications using a wide range of attributes other than power-system mass and volume. Open cycle, closed cycle, and closed power system/weapon platform concepts were studied. The purpose of this paper is to summarize the salient results of these studies, identify important trends and future study needs.

2971 **(NUKEM-FuE—87062) Safety aspects of nuclear power sources (NPS) for electricity generation in space. Interim summary report. Project phase 1: November 1986 - December 1987.** (Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.); Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Raumflug- und Reaktortechnik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1988. 311p. Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.).

It is the objective of this study to establish a quantified account of the possible hazards caused by the use of NPS and to derive criteria for the safe deployment of such devices, in order to provide the Government of the FRG with a decision aid for its future attitude in the matter of NPS use in space. From the general target subtargets have been derived: 1) models for the calculation or the estimation of possible hazards at least within reasonable boundaries; 2) safety criteria using generally agreed ICRP recommendations; 3) evaluation and comparison of hazards and risks with accident consequences; 4) recommendations for safety measures.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 2977, 3059

2972 **(NUREG—0940-Vol.7-No.2) Enforcement actions: Significant actions resolved: Quarterly progress report, April--June 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Enforcement). Aug 1988. 329p. NTIS, PC A15/MF A01 - GPO. Order Number TI88017310/JAW.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (April--June 1988) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to licensees with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to those described in this publication.

2108 Economics

REFER ALSO TO CITATION(S) 2981

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 2963

2973 **(CTA-IEAV-RP—008/88) Review on the procedures ETOG-3 and FLANGE-II for the calculation of resonances and background cross sections.** Chalhoub, E.S.; Anaf, J. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Apr 1988. 33p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704174/JAW.

The procedures for calculating contributions of resolved and unresolved resonances and background cross sections, in ETOG-3 and FLANGE-II, were revised. The formalism for calculating resolved resonance cross sections, in ETOG-3, was substituted by another, on quadratures, originating the version ETOG-3Q. The validated ETOG-3 and FLANGE-II codes now generating results in accordance with their originally established procedures.

2974 **(LA-UR—88-3371) A one- and two-dimensional cross-section sensitivity and uncertainty path of the AARE [Advanced Analysis for Reactor Engineering] modular code system.** Davidson, J.W.; Dudziak, D.J.; Higgs, C.E.; Stepanek, J. (Los Alamos National Lab., NM (USA); Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)). 1988. Contract W-7405-ENG-36. 9p. (CONF-880906—12). NTIS, PC A02/MF A01. Order Number DE89002290/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

AARE, a code package to perform Advanced Analysis for Reactor Engineering, is a linked modular system for fission reactor core and shielding, as well as fusion blanket, analysis. Its cross-section sensitivity and uncertainty path presently includes the cross-section processing and reformatting code TRAMIX, cross-section homogenization and library reformatting code MIXIT, the 1-dimensional transport code ONEDANT, the 2-dimensional transport code TRISM, and the 1- and 2- dimensional cross-section sensitivity and uncertainty code SENSIBL. IN the present work, a short description of the whole AARE system is given, followed by a detailed description of the cross-section sensitivity and uncertainty path. 23 refs., 2 figs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 3266

2975 **(CEGB-TPRD/L—3258/R88) Assessment of the moving point method for numerical calculation of fluid-structure interaction in water hammer.** Edwards, N.A.; Please, C.P. (Central Electricity Research Labs., Leatherhead (UK); Southampton Univ. (UK)). (Central Electricity Research Labs., Leatherhead (UK)). Mar 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755477/JAW.

The problem of providing an accurate numerical method for modelling fluid-structure interaction in practical water hammer calculations for power station pipe networks is addressed. The application of the moving point method to a problem representative of practical water hammer is presented. A suitable model including both liquid pressure waves and pipe wall tension waves if formulated as a set of partial differential equations with algebraic equations and boundary and initial conditions. The problem is non-dimensionalized, to identify key parameters, and a suitable linearized problem is constructed by omitting small terms. The problem is transformed to characteristic variables which are shown to be simply transported along the pipe without change of value. This motivates the choice of the moving point method. In the course of the work a program WHOMP (Water Hammer On Moving Points) was developed which exploits the moving point method. It is specific to the problem of a single pipe with thin elastic walls but the boundary and initial conditions permitted are sufficiently general that any reasonable physical problem for a single pipe can be addressed. Results of WHOMP for the model problem are compared with experimental and other numerical results including superficially those from a commercially available code FLUSTRIN. Some consideration of extending the moving point method to practical pipe networks is given. This includes the incorporation of bending and torsion waves in the pipe wall and incorporation of additional physics leading to significant non-linearity.

2976 **(CONF-8810155—4) HSST wide-plate test results and analysis.** Naus, D.J.; Bass, B.R.; Keeney-Walker, J.; Fields, R.J.; deWit, R.; Low, S.R. III. (Oak Ridge National Lab., TN (USA); National Inst. of Standards and Technology, Gaithersburg, MD (USA)). 1988. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01. Order Number DE89002192/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Fifteen wide-plate crack-arrest tests have been completed to date, ten utilizing specimens fabricated from A533B class 1 material (WP-1 and WP-CE series), and five fabricated from a low upper-shelf base material (WP-2 series). Each test utilized a single-edge notched specimen that was subjected to a linear thermal gradient along the plane of crack propagation. Test results exhibit an increase in crack-arrest toughness with temperature, with the rate of increase becoming greater as the temperature increases. When the wide-plate test results are combined with other large-specimen results the data show a consistent trend in which the K/sub Ia/ data extends above the limit provided in ASME Section XI. 24 refs., 11 figs., 7 tabs.

2977 **(PNL-SA—14565) ASME Section XI activities: Past, present and future.** Bush, S.H. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 11p. (CONF-880962—1). NTIS, PC A03/MF A01. Order Number DE89001734/JAW.

From 6. international conference on pressure vessel technology; Beijing, China (11 Sep 1988).

This paper presents a broad overview of ASME Section XI on "Inservice Inspection of Nuclear Power Plant Components" as it was, as it is, and as it is expected to be. The structure and principal components of XI are presented as well as how it functions. This Code has found international usage and our meetings are attended, as participants or visitors, by representatives from several countries. We welcome such interactions and hope they will continue. In the future we anticipate major changes in the Code for a variety of reasons such as the current lack of growth of the nuclear industry in the United States and the emphasis on plant life extension. 4 tabs.

2203 Fuel Elements

2978 **(CORR—880273) Consequences of non-wetting behavior of Mark 16B and Mark 22 assemblies: [Deleted Version].** Steimke, J.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 8 Jan 1986. Contract AC09-76SR00001. 5p. NTIS, PC A02/MF A01. Order Number DE89002442/JAW.

In the NED Weekly Highlights date December 19, 1985, I stated that the non-wetting behavior of Mark 16B and Mark 22 assemblies might have negative consequences on ECS power limits and discharge cooling of reactor assemblies. My statement was based on heat transfer experiments with a stainless steel heater. Recent calculations for discharge cooling show that the higher thermal conductivity of the aluminum-uranium alloy used in fuel tubes would compensate for the non-uniform distribution of coolant found in non-wetting tubes. I conclude that wettability is not a factor in discharge cooling. Assembly powers after a LOCA would be higher than discharge powers. An approximate calculation of ECS power limits concluded that non-wetting Mark 16B and Mark 22 assemblies would limit assembly power in the winter. The

powers of the hottest Mark 16B and Mark 22 assemblies would have to be limited to 83% and 85%, respectively, of the highest powers run in recent years. I do not recommend that any action be taken until the research is completed and reviewed by peers. Work on a new melting model for LOCA conditions and both wetting and non-wetting surfaces is my highest priority work.

2979 **(CTA-IEAV-NT—004/88) Fuel selection for radioisotope thermoelectric generators.** Menezes, A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Jun 1988. 24p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704170/JAW.

The availability of Radioisotope Thermoeletric Generator fuels is evaluated based on the amount of fuel discharged from selected power reactors. In general, the best alternatives are either to use Plutonium-238 produced by irradiation of Neptunium-237 generated in typical thermal reactors or to use Curium-244 directly separated from the discharged fuels of fast or thermal reactors.

2980 **(IEN-DERE-GAR—03/84) Analysis of reactivity transients and heat conduction in cylindrical fuel rod.** Botelho, D.A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 22 Aug 1984. 54p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704246/JAW.

The derivation of an algorithm for calculating the transient temperature distribution in a cylindrical fuel rod from the Paret computer code is presented. The finite diference method and the Crank-Nicholson method are used. (Σ.G.).

2981 **(ITEF—152(1987)) Damage of fuel assembly premature changing in a power reactor.** Rudik, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704817/JAW.

Material balance, including energy recovery and nuclear fuel flow rate, under conditions of premature FA extraction from power reactor is considered. It is shown that in cases when before and after FA extraction reactor operates not under optimal conditions damage of FA premature changing is proportional to the first degree of fuel incomplete burning. If normal operating conditions of reactor or its operation after FA changing is optimal, the damage is proportional to the square of fuel incomplete burning. 9 refs.

2204 Control Systems

REFER ALSO TO CITATION(S) 2965

2982 **(CONF-881208—1) Automated generation of nonlinear system characterization for sensor failure detection.** Frei, Z.; Upadhyaya, B.R. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). 1988. Contract AC02-86NE37959. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008740/JAW.

From 27. IEEE conference on decision and control; Austin, TX, USA (7 Dec 1988).

Independent estimation of critical signals is required for use in consistency checking of instrument outputs, and for isolating common-mode failures. When measurement redundancy is not available, this method can be used for monitoring sensor degradation or sensor drifts by on-line prediction of the sensor output. A methodology is developed to characterize a given critical signal as a function of other related variables in a process by a nonlinear minimum-term model. This steady-state characterization is fully automated and implemented on an IBM PC, and is applied for sensor failure monitoring in a power plant and a process control industrial system. 5 refs., 5 figs.

2983 **(DOE/NE/37959—20) Computation of data-driven models with application to power plant signal validation.** Upadhyaya, B.R.; Holbert, K.E. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). Jun 1988. Contract AC02-86NE37959. 7p. (CONF-881011—20). NTIS, PC A02/MF A01. Order Number DE88017077/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

The prediction of process variables can be achieved either by accurate physical modeling or by data-driven empirical modeling of a plant subsystem. The estimation of safety and control system instrument outputs is useful for consistency checking of redundant measurements, for use as an independent approach for comparing an instrument output with its predicted value, and for isolating common-mode failure of instrument channels. Steady-state empirical models may be developed using plant operational data from different steady-state conditions, or using a large amount of data from a single steady-state operation. Both approaches are being studied as part of a US Department of Energy sponsored project on signal validation at the University of Tennessee. An automated procedure for generating empirical models directly from operational plant data has been developed. 3 refs., 2 figs.

2984 **(DOE/NE/37959—21) Signal validation using simultaneous consistency checking of multivariable measurements.** Gloeckler, O.; Morgenstern, V.M.; Upadhyaya, B.R. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). Jun 1988. Contract AC02-86NE37959. 6p. (CONF-881011—21). NTIS, PC A02/MF A01. Order Number DE88017078/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

Since the incident at Three-Mile-Island II, computerized plant status display, human factors in control room design and other plant monitoring tools available to plant personnel have seen a tremendous growth. One such proposed operator aid is a plant signal validation system. The need for automated on-line signal validation is necessary because of the large amount of information available, and as a result the operator's ability to validate information manually reaches the limit. As part of the US Department of Energy sponsored project, research is being performed at the University of Tennessee to develop a comprehensive signal validation system. This report describes this research. 3 refs., 1 fig.

2985 **(DOE/NE/37959—22) Development of an expert system for signal validation.** Qualls, A.L.; Uhrig, R.E.; Upadhyaya, B.R. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). Jun 1988. Contract AC02-86NE37959. 6p. (CONF-881011—22). NTIS, PC A02/MF A01. Order Number DE88017079/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

Diagnosis of malfunctions in power plants has traditionally been in the domain of the process operator, who relies on training, experience, and reasoning ability to diagnose faults. The previous work in the development of operator aids for fault diagnosis has focused on detecting and diagnosing process anomalies. The most significant advances in the application of expert systems to process diagnostics has involved construction of computer models with interconnecting nodes. General principles of the plant process are used to isolate the cause of a possible anomaly to one of the nodes. Another approach to process diagnosis is to identify the cause of a possible anomaly with an event-cause model of the process. We describe a method of signal validation using expert system technology which detects possible anomalies in an instrument channel's output, similar to the procedure used by an operator.

2986 **(DOE/NE/37959—23) Signal anomaly detection using modified CUSUM [cumulative sum] method.** Morgenstern, V.; Upadhyaya, B.R.; Benedetti, M. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). 1988. Contract AC02-86NE37959. 8p. (CONF-881208—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88008739/JAW.

From 27. IEEE conference on decision and control; Austin, TX, USA (7 Dec 1988).

An important aspect of detection of anomalies in signals is the identification of changes in signal behavior caused by noise, jumps, changes in band-width, sudden pulses and signal bias. A methodology is developed to identify, isolate and characterize these anomalies using a modification of the cumulative sum (CUSUM) approach. The new algorithm performs anomaly detection at three levels and is implemented on a general purpose computer. 7 refs., 4 figs.

2987 (INIS-SU—55, pp 9-15) **Calculational-theoretical studies of the system of local automated regulators and lateral ionization chambers.** Aleksakov, A.N.; Emel'yanov, I.Ya.; Nikolaev, E.V.; Panin, V.M.; Podlazov, L.N.; Rogova, V.D. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Methods of engineering synthesis of the systems for nuclear reactor local automated power regulation and radial-azimuthal energy distribution stabilization operating according to lateral ionization chamber signals are described. Results of calculational-theoretical investigations into the system efficiency and peculiarities of its reaction to some perturbations typical of the RBMK type reactors are considered. 7 refs.; 7 figs.

2988 (INIS-SU—55, pp 16-22) **Change in the sensitivity of β-emission detectors of neutron flux with rhodium emitter during long-time in-pile operation.** Akimov, I.S.; Tukhvetov, F.T. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Change in sensitivity of self-powered neutron detectors with rhodium emitters in the course of operation is investigated. The detectors are used for Bilibin NPP reactor fuel channel power monitoring. Emitter nucleus burnup is calculated and its dependence on neutron flux spectral characteristics is analysed. Comparison of the data obtained to measurement results shows that the detector sensitivity changes according to the linear law up to the generated charge values $\leq$5 c/cm. At high burnups it is necessary to introduce corrections taking account of neutron flux spectral characteristics. A conclusion is drawn that the change of neutron flux distribution with height effects sufficiently the indications of detectors with different burnups. The effect becomes notable at burnups of the order of 2 c/cm. 5 refs.; 5 figs.; 1 tab.

2989 (INIS-SU—55, pp 23-27) **MIKRO-SVZ type reactor control system.** Ansimov, L.Ya., Korolev, V.V.; Slekenichs, Ya.V.; Kotov, K.M.; Tkachenko, G.E. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Experience in development and operation of micromodulus contactless circuits for control, regulation, blocking, alarm and emergency protection of zero power reactors is described. The whole system is produced on the base of the intergrated circuits of the increased integration degree. A special attention is paid to the problem of reliability, sensitivity, noise immunity and portability of the equipment with nuclear safety rules being observed. 6 refs.; 1 fig.

2990 (INIS-SU—55, pp 28-34) **Analysis of the PG-2 steam generator acoustic noises at the BOR-60 reactor.** Sokolov, V.M.; Afanas'ev, V.A.; Golushko, V.V.; Grebenkin, Yu.P.; Muralev, A.B. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Results of investigation into acoustic background noises and noises under simulation of argon leaks in the PGN-200 M (PG-2) steam generator model, installed in the BOR-60 reactor are presented. Acoustic monitor signal processing according to algorithms for calculation of dispersion, power spectral density and mutually correlated function was performed using a computing system for random process digital processing. The obtained data analysis shows that under the change of the water flow rate by 10% and perturbation by sodium flow rate for 50 m/sup 3//h the mean value of the steam generator acoustic noise dispersion may increase by 35-40%, dispersion oscillation range increases in relation to the mean level and separate pulses exceeding the mean signal level several times occure. Acoustic monitors located at 2m distance from a leak point respond to argon leaks with o.11 g/s flow rate creating signal-to-noise ratio equalling to 4-6. A conclusion is drawn concerning the perspectiveness of acoustic method appication for detecting water leaks in sodium. Unambiguity of the choice of optimal signal processing algorithm for the leaks identification is underlined. Such an algorithm should contain information concerning leak noises and noises occuring under reaction product transfer along steam generator. 6 figs.

2991 (INIS-SU—55, pp 35-42) **Measuring the performances of in-core radiation detectors in a radiation loop.** Dindun, A.S.; Kramer, M.M.; Efanov, A.I.; Malinkin, V.M.; Postnikov, V.V.; Proshin, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Results of investigations into the sensitivity of the KtV-type small-sized triaxial ionization chambers and cable type Compton emission detectors to gamma radiation are presented. The detectors under consideration are included into automated systems for power distribution, monitoring and control in nuclear reacor cores. Investigations are performed in the RK-LM in-pile loop operating in the IRT-M reactor. Gamma radiation dose rate corresponds to 10/sup 5/ g.eq. of radium. The liquid metal alloy containing 25% indium+62% gallium+13% tin is used as a gamma source. The detector sensitivity calibration is performed without activation of their structural materials with mean-square error being no more than +-4%. The obtained data show that ionization chamber sensitivity to gamma radiation under reactor and loop conditions agree well enough with each other. Ionization chamber sensitivity difference from one another makes up no more than 30%. Emission detector sensitivity spread from the mean value does not exceed +-10%. 6 refs.; 4 figs.; 2 tabs.

2992 (INIS-SU—55, pp 46-50) **Application of microprocessors in nuclear reactor control systems.** Budnevskij, G.L.; Gusev, M.Yu.; Zel'tser, A.S.; Kazachkov, V.I.; Shmuehl'zon, M.B.; Tsoj, Yu.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Peculiarities of applying the microprocessors in nuclear reactor control systems are considered. The control system information-logic subsystem for a power unit with the BN-320 reactor is described. The subsystem engineering structure is presented, its operational principles and performance are considered. 3 refs.; 1 fig.

2993 (INIS-SU—55, pp 51-56) **Nuclear reactor control and protection instruments.** Vlasov, V.I.; Pilyaev, A.P.; Vasenkov, V.I.; Patrin, S.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

The following subsystems are presented: the BAR-6 unit for reactor automated control and protection by power and period; the ZM-6 unit as a power setting controller. Descriptions of the flowsheet and separate basic units are given. Basic performance and field testing results are briefly presented. The structural layout control systems on the basis of these devices is considered. 2 refs.; 5 figs.

2994 (INIS-SU—55, pp 57-60) **K580 microprocessor-based automated power control system for a nuclear reactor.** Grishin, V.V.; Il'ichev, I.V.; Mikheev, A.V.; Filippov, A.G.; Shevchenko, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Description of a closed system for reactor power control based on the K580 microprocessor is given. Control algorithm providing for a satisfactory regulation quality within the range of (1-100)% of nominal power is proposed. The structural layout of the automated control system and software is described. 2 refs.; 3 figs.

2995 (INIS-SU—55, pp 61-64) **Digital instrument for nuclear reactor period measurement.** Pilyaev, A.P.; Vasenkov, V.I.; Patrin, S.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Description of the functional layout of the nuclear reactor period digital meter is presented. The main error sources are considered. Results of testing the mock-up of reactor start-up period digital meter are reported, its error being about 2%, fast responce is 1s. 2 refs.; 3 figs.

2996 (INIS-SU—55, pp 65-70) **Selection of optical scram settings on the base of the statistical decision method.** Kozin, I.O.; Sal'nikov, N.L. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Problem of determinig the optimal scram settings by the level and rate of the controlled parameter for NPP equipment is solved. The problem of scram setting choice is closely connected with questions of economical efficiency and fast response. It is shown that the setting increase makes the system less subjected to disturbances and failures but at the same time leads to accident time increase; the setting reduction may lead to false equipment stopping. It is assumed that noises in the controlled parameter mesurements appear to be the steady Gauss process with a certain correlation function. 6 refs.; 2 figs.

2997 (INIS-SU—55, pp 71-73) **On the organization of a computer-based file of operational parameters for NPPs with the RBMK type reactors.** Berbushenko, A.A.; Vedernikov, A.V.; Zagrebaev, A.M.; Ivanenko, V.G.; Pryanichnikov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhniki.; no.7.

In Control of nuclear reactors. Scientific-technical collection.

Organization of a file of operational parameters for NPP with the RBMK-1000 reactor which is currently realized at the Chernobyl NPP on the base of the M-6000 computer is described. The given organization of the operational parameter file is also possible for NPPs with the WWER type reactors. 5 refs.

2998 **(INIS-SU—55) Control of nuclear reactors. Scientific-technical collection.** (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1987. 84p. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780023/JAW.

Voprosy atomnoj nauki i tekhnik.; no.7.

Separate abstracts were prepared for the individual papers in this report. (JDB)

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 3004, 3009, 3028, 3029, 3032, 3549

2999 **(SAND—88-1504C) Direct containment heating and aerosol generation during high pressure melt ejection experiments.** Tarvell, W.W.; Brockmann, J.E.; Washington, K.E.; Pilch, M.; Marx, K.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 17p. (CONF-881011—29). NTIS, PC A03/MF A01. Order Number DE89002022/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

Containment loading in the form of increased atmosphere pressure and temperature during a severe reactor accident can result from the expulsion of core debris from the reactor cavity. This increase in the pressure and temperature can be accompanied by an aerosol source term that may have enhanced compositions of the more volatile radionuclide. Large scale experiments have been conducted in the Surtsey facility at Sandia National Laboratories to study the energy exchange processes and the generation of aerosols. Test results are reported here and compared to analytical predictions made by an experiment analysis code and a containment response model. The experiments show that the energy exchange and aerosol generation processes are greatly affected by trapping of the debris on the surfaces of the test chamber. Good agreement is achieved between experimental data and model predictions by incorporating models for debris trapping on surfaces and the formation of the retained material into drops that fall through the chamber at late time. 23 refs., 11 figs., 4 tabs.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 2956, 2968, 2969, 2989, 3024, 3026, 3433

3000 **(WHC-EP—0156) Thermal-hydraulic analysis of TFE verification test UFAC-1.** McWethy, L.M.; Pearce, K.L.; Rector, D.R. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930;AC06-76RL01830. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE89002138/JAW.

The Experimental Breeder Reactor No. II (EBR-II) irradiation test Uninstrumented Fueled Accelerated (UFAC)-1 of seven encapsulated thermionic test pins was analyzed with the code COBRA-SFS. The model predicted coolant and material temperatures for three conditions of interest: steady state full power, response to the unlikely loss of flow transient, and decay heat cooling by forced down flow of argon. Modeling assumptions and a summary of results are included. 1 ref., 12 figs., 3 tabs.

3001 **(WHC-SA—0127) Simulated transient behavior of HT9 cladding.** Cannon, N.S.; Huang, F.H.; Hamilton, M.L. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 21p. (CONF-880613—23). NTIS, PC A03/MF A01. Order Number DE89002145/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, USA (27 Jun 1988).

Simulated transient tests were performed on sections of HT9 fast- reactor fuel pin cladding irradiated to a fast fluence of nearly 16 {times} 10^{22} n/cm^2 at temperatures ranging from 370 to 620{degree}C. After removing fuel, these specimens were internally pressurized and heated at one of several constant rates (0.56, 5.6,

or 110{degree}C/s) until specimen failure occurred. A slight reduction of strength was observed in irradiated cladding, particularly at 110{degree}C/s, when compared with transient results from unirradiated HT9 control specimens; however, this strength reduction did not correlate with either fluence or irradiation temperature. A small reduction of ductility was also observed for irradiated cladding failing at temperatures above 800{degree}C at the lower heating rates (0.56 or 5.6{degree}C/s); irradiated cladding was generally more ductile at 110{degree}C/s than unirradiated HT9 cladding. The HT9 cladding results were compared with similar transient data obtained previously from 20% Cold-Worked Type 316 Stainless Steel (316 SS) cladding. In the unirradiated state, this austenitic cladding is stronger and less ductile than HT9 cladding. However, the 316 SS cladding undergoes a significant loss of strength and ductility during irradiation when in contact with oxide fuel, by a mechanism labeled the fuel adjacency effect (FAE). The FAE is believed to be liquid metal embrittlement from fission products. The HT9 fuel pin cladding remained as strong or stronger than the 316 SS cladding when irradiated in contact with fuel, showing no evidence of the FAE up to the high fluences reported here. The ductility of the irradiated HT9 fuel pin cladding remained significantly greater than that of irradiated 316 SS cladding. 14 refs., 11 figs., 1 tab.

3002 **(WHC-SA—0272) Multi-frequency binary sequence testing at the Fast Flux Test Facility (FFTF).** Harris, R.A.; Chien, Y.M.; Clark, D.A.; Ritter, W.M.; Bennett, R.A.; Rothrock, R.B. Jr.; Sevenich, R.A. (Westinghouse Hanford Co., Richland, WA (USA); Los Alamos National Lab., NM (USA); Eastern Washington Univ., Cheney (USA). Dept. of Computer Science). Jun 1988. Contract AC06-87RL10930. 13p. (CONF-880911—20). NTIS, PC A03/MF A01. Order Number DE89000507/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The multi-frequency binary sequence experimental technique has been implemented at the Fast Flux Test Facility for routine surveillance activities. The frequency content of the standard rod-movement sequence has been shown to be sufficient to normalize the data at moderate frequencies. This obviates the need for auxiliary calibration measurements and provides the reactivity worth of the test control rod. Analyses of a series of tests conducted in 1986 illustrate that the rod worths inferred from the tests are consistent with zero-power measurements. Also, the dependence of the prompt feedback time constant on reactor conditions was determined. 5 refs., 11 figs., 2 tabs.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 2956, 3015, 3016, 3038

2208 Propulsion Reactors

3003 **(PNL-SA—15519) Unique mission options available with a megawatt-class nuclear electric propulsion system.** Coomes, E.P.; McCauley, L.A.; Christian, J.L.; Gomez, M.A.; Wong, W.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 10p. (CONF-880764—5). NTIS, PC A02/MF A01. Order Number DE89001738/JAW.

From 24. AIAA/ASME/SAE/ASEE joint propulsion conference; Boston, MA, USA (11 Jul 1988).

The advantages of using electric propulsion systems are well-known in the aerospace community with the most common being its high specific impulse, lower propellant requirements, and lower system mass. But these advantages may not be as important as the overall unique mission options electric propulsion makes possible, especially if the system is powered by a megawatt-class nuclear electric power source. Although the lack of suitable electric power systems has been a major drawback to electric propulsion, recent efforts have shown megawatt-class nuclear electric power systems are feasible and could be available by the turn of the century. Coupling this with the resurgence in interest in free-space electromagnetic transmission of energy and technology developments in this area provide a whole new aspect to the view of electric propulsion. The propulsion system now has a second mission function that may be of more value than the well understood benefits of electric propulsion; that is providing large quantities of prime power in support of a broad spectrum of mission tasks. 30 refs., 9 figs.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 2901, 2947, 2953, 2954, 2976, 2977, 2978, 2984, 2985, 2999

3004 **(AERE-R—12956) Fission gas release from uranium dioxide in high temperature transients.** Small, G.J. (Birmingham Univ. (UK)). (UKAEA Harwell Lab. Materials Development Div.). May 1988. 120p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754763/JAW.

The experiments described in this thesis investigate the kinetics and mechanisms for release of inert fission gases from irradiated fuel (uranium dioxide) during temperature transients, occuring in AGR type and PWR type reactors. A description is given of the fundamental physical properties of uranium dioxide with particular emphasis placed on the effects of irradiation damage and the build-up of fission product concentrations. A brief review is given of the principle mechanisms by which gases are thought to be released, covering both thermal and irradiation induced processes. The main design features of the Civil Advanced Gas Cooled Reactor (CAGR) and Pressurised Water Reactor (PWR) systems, concentrating on the specifications and normal operating conditions of the uranium dioxide fuel. This is followed by a brief description of the conditions anticipated during postulated reactor malfunctions. Two classes of fault are considered, in which the fuel temperature increases through loss of coolant efficiency or a rise in heat generation rate.

3005 **(BMU—1986-130) Joint statement by the chairmen of the Standing Committee on Reactors and the Reactor Safety Commission on safety-related documents drawn up under the Franco-German Commission on Safety Questions for Nuclear Installations (DFK). August 29, 1986.** (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)). Sep 1986. 61p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.; Translated from French: Conclusions d'une reunion des presidents du Groupe Permanent Reacteurs et de la RSK sur des documents relatifs a la surete etablis par la DFK. 29 aout 1986.

The report contains: 1. The present situation regarding hints and recommendations in the safety declaration by the TUEV Baden on the subject of Cattenom nuclear power station in June 1982. 2. The present situation regarding hints and recommendations in the declaration by the TUEV Rhineland in February 1982 on the subject of radiological aspects and features of the Cattenom site for the nuclear power plant. 3. Answers to press allegations about the safety of Cattenom NPP: scram system, safety cooling system, heat sink for after-heat removal, emergency power supplies, load-follow operation, air crashes, susceptibility to failures.

3006 **(BMU—1988-187) German precursor study.** Frey, W.; Hoertner, H.; Linden, J. v.; Rappl, G.; Reichart, G. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1988. 122p. (In German). (GRS-A—1370). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

Results of a first plant-specific precursor study are presented. Using plant-specific operating experience, precursors to potential severe core damage accidents were assessed. The main steps of the study are: assessment of the plant-specific frequencies of the initiating events; estimation of the probabilities of system failures using plant-specific unavailabilities of the system trains, evaluation of the

operating experience (16 years) of Biblis A and B on actual or potential system failures and multiple failures, evaluation of operator errors based on the plant-specific operating experience, performance of a parameter uncertainty analysis. The quantification of the precursors to potential severe core damage accidents is based on the minimal requirements for the systems laid down in the licensing process for full load operation. Using a realistic evaluation there are often fewer system trains necessary than specified by these minimal requirements. A value of 5x10/sup -5/ per year of reactor operation was estimated to be the overall result of the mean frequency of potential severe core damage accidents corresponding to the observed precursors. The parameter uncertainty analysis yielded an upper subjective 95% confidence limit of 5x10/sup -4/ per year of reactor operation. Analysis of the time-dependent trend showed a clear decrease in frequency as a function of increasing operating time.

3007 **(BMU—1988-190) Computer code TESPA for probabilistic description of cladding behavior after accidents.** Keusenhoff, J. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1988. 49p. (In German). (GRS-A—1432). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

The computer code TESPA calculates cladding failures after loss-of-coolant accidents in LWR-plants. A number of calculations connected by probabilistic input data can be combined to an overall probabilistic calculation.

3008 **(BMU—1988-191) Investigations on damage mitigating measures. Final report.** Bracht, K.; Chakraborty, A.K.; Herbold, G.; Kersting, E.; Tiltmann, M. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1988. 98p. (In German). (GRS-A—1230). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

For two event sequences leading to a complete core meltdown in case of no countermeasures, the efficiency of operator intervention with existing operational- and/or safety-systems to prevent severe core damage has been investigated. The advanced thermohydraulic code DRUFAN-02 was used to analyse two variations of an emergency power case. Exemplarily only interventions concerning the primary system were investigated. By a depressurization of the primary circuit initiated 0.5 to 1,5 hours after start of the sequence, core damage can be prevented or at least delayed sufficiently, to get time for additional countermeasures. Investigations performed to assessed the potential of constructive countermeasures to mitigate the consequences of a core melt accident with containment overpressurization showed that only controlled late containment venting should be investigated in more detail in the future. This measure has different advantages especially with respect to accident management actions. A cost effective realization of such a system seems to be possible. Containment venting is also a messure which is discussed intensely in France and in Sweden and shall be realized there in the near future. Sufficient safe measures to handle the H/sub 2/-problem in the containment during severe accidents with core melt are still not available. A new measure based on absorption of H/sub 2/ seems to have a great potential to contribute to the solution of the H/sub 2/-problem.

3009 **(BNL-NUREG—41553-Rev.) Analysis of fission product revaporization in a BWR Reactor Coolant System during a station blackout accident.** Yang, J.W.; Schmidt, E.; Cazzoli, E.; Khatib-Rahbar, M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 10p. (CONF-881011—19-Rev.). NTIS, PC A02. Order Number DE89001095/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

This paper presents an analysis of fission product revaporization from the Reactor Coolant System (RCS) following the Reactor Pressure Vessel (RPV) failure. The station blackout accident in a BWR Mark I Power Plant was considered. The TRAPMELT3 models for vaporization, chemisorption, and the decay heating of RCS structures and gases were used and extended beyond the RPV failure in the analysis. The RCS flow models based on the density-difference or pressure-difference between the RCS and containment pedestal region were developed to estimate the RCS outflow which carries the revaporized fission product to the containment. A computer code called REVAP was developed for the analysis. The REVAP code was incorporated with the MARCH, TRAPMELT3 and NAUA codes from the Source Term Code Package (STCP) to estimate the impact of revaporization on environmental release. The results show that the thermal-hydraulic conditions between the RCS and the pedestal region are important factors in determining the magnitude of revaporization and subsequent release of the volatile fission product into the environment. 6 refs., 8 figs.

3010 **(BNL-NUREG—41753) Low-pressure cutoff for melt dispersal from reactor cavities.** Tutu, N.K.; Ginsberg, T.; Finfrock, C. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-881011—26). NTIS, PC A02/MF A01. Order Number DE89001096/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

A series of debris dispersal experiments using a 1/42-scale model of the Surry cavity without internal structure was performed. The experimental data showed that in addition to the Kutateladze number (based upon the area averaged gas velocity), the fraction of melt simulant retained within the cavity was also dependent upon the hole size and the density of the driver gas. A correlation that fit all the data reasonably in the region of the debris dispersal threshold was used to develop a low-pressure cutoff criteria for debris dispersal for the Surry cavity. 8 refs., 7 figs., 3 tabs.

3011 **(CONF-881014—14) Experiments on natural circulation during PWR severe accidents and their analysis.** Sehgal, B.R.; Stewart, W.A.; Sha, W.T. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01. Order Number DE89000544/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

Buoyancy-induced natural circulation flows will occur during the early-part of PWR high pressure accident scenarios. These flows affect several key parameters; in particular, the course of such accidents will most probably change due to local failures occurring in the primary coolant system (CS) before substantial core degradation. Natural circulation flow patterns were measured in a one-seventh scale PWR PCS facility at Westinghouse R&D laboratories. The measured flow and temperature distributions are report in this paper. The experiments were analyzed with the COMMIX code and good agreement was obtained between data and calculations. 10 refs., 8 figs., 2 tabs.

3012 **(CONF-8809178—1) Utilization of experimental integral data for the adjustment and uncertainty evaluation of reactor design quantities.** Poenitz, W.P.; Collins, P.J. (Argonne National Lab., Idaho Falls, ID (USA)). 1988. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01. Order Number DE89000524/JAW.

From European Organization for Economic Cooperation and Development's Nuclear Energy Agency Committee on Reactor Physics (NAECRP) specialists meeting; Jackson Hole, WY, USA (23 Sep 1988).

Biases and uncertainties of calculated reactor design quantities caused by errors and uncertainties of basic parameters, such as neutron cross sections, fission spectra parameters, and prompt and delayed neutron yields, are large, and in most cases, exceed reactor design requirements. Errors and uncertainties due to models and methods approximations contribute as well. An extensive data base, with presently {approximately}300 experimental integral values from 28 critical assemblies, has been assembled at Argonne National Laboratory in order to provide improvements and to investigate

both sources of uncertainties. Generalized-least-squares fitting is being used. The available large data base permitted the investigation of the influence of specific input data, the constraints of the covariance information, the selection of parameters, and the reliability of the predictions. It is shown that reliable improvements of calculated quantities like enrichment, breeding ratio, sodium void, control rod worth, power distribution, and material worth can be made. Substantial reductions of the uncertainties of these quantities, which are caused by the uncertainties of the basic parameters, are obtained in most cases. The FFTF uranium-metal-core conversion is the first application of the present effort. 21 refs., 2 figs., 10 tabs.

3013 **(CONF-8810155—12) BWRSAR [Boiling Water Reactor Severe Accident Response] calculations of reactor vessel debris pours for Peach Bottom short-term station blackout.** Hodge, S.A.; Ott, L.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01. Order Number DE89002319/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

This paper describes recent analyses performed by the BWR Severe Accident Technology (BWRSAT) Program at Oak Ridge National Laboratory to estimate the release of debris from the reactor vessel for the unmitigated short-term station blackout accident sequence. Calculations were performed with the BWR Severe Accident Response (BWRSAR) code and are based upon consideration of the Peach Bottom Atomic Power Station. The modeling strategies employed within BWRSAR for debris relocation within the reactor vessel are briefly discussed and the calculated events of the accident sequence, including details of the calculated debris pours, are presented. 4 refs., 13 figs., 3 tabs.

3014 **(DOE/NE/37970—T7) Severe transient analysis of the Penn State University Advanced Light Water Reactor.** Borkowski, J.A. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering). Aug 1988. Contract AC02-86NE37970. 82p. NTIS, PC A05/MF A01. Order Number TI89001869/JAW.

The Penn State University Advanced Light Water Reactor (PSU ALWR) incorporates various passive and active ultra-safe features, such as continuous online injection and letdown for pressure control, a raised-loop primary system for enhanced natural circulation, a dedicated primary reservoir for enhanced thermal hydraulic control, and a secondary shutdown turbine. Because of the conceptual design basis of the project, the dynamic system modeling was to be performed using a code with a high degree of flexibility. For this reason the modeling has been performed with the Modular Modeling System (MMS). The basic design and normal transients have been performed successfully with MMS. However, the true test of an inherently safe concept lies in its response to more brutal transients. Therefore, such a demonstrative transient is chosen for the PSU ALWR: a turbine trip and reactor scram, concurrent with total loss of offsite ac power. Diesel generators are likewise unavailable. This transient demonstrates the utility of the pressure control system, the shutdown turbine generator, and the enhanced natural circulation of the PSU ALWR. The low flow rates, low pressure drops, and large derivative states encountered in such a transient pose special problems for the modeler and for MMS. The results of the transient analyses indicate excellent performance by the PSU ALWR in terms of inherently safe operation. The primary coolant enters full natural circulation, and removes all decay heat through the steam generators. Further, the steam generators continually supply sufficient steam to the shutdown power system, despite the abrupt changeover to the auxiliary feedwater system. Finally, even with coincident failures in the pressurization system, the primary repressurizes to near-normal values, without overpressurization. No core boiling or uncovery is predicted, and consequently fuel damage is avoided. 17 refs., 19 figs., 4 tabs.

3015 **(DPST—88-226) Deposited power limits to avoid flow instability during a LOCA [loss-of-coolant accident] in P-10.2.** Aleman, S.E. (Savannah River Lab., Aiken, SC (USA)). Jan 1988. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01. Order Number DE89001643/JAW.

Assembly power limits have been established to prevent bulk boiling of the coolant in SRP reactor assemblies during a design basis loss-of-coolant accident (LOCA). This memorandum provides the methodology for calculating deposited power limits for the P-10.2 subcycle to avoid the onset of flow instability during a LOCA. 10 refs., 1 tab.

3016 **(DPST—88-546) Reactor materials program process water piping: K Reactor indirect failure probability.** Daugherty, W.L. (Savannah River Lab., Aiken, SC (USA)). 9 May 1988. Contract AC09-76SR00001. 8p. (ECS-LOCA—11). NTIS, PC A02/MF A01. Order Number DE89002459/JAW.

The hypothetical maximum rate loss of coolant accident (LOCA) for the Savannah River Production Reactors is the abrupt double-ended guillotine break (DEGB) of a large process water pipe. This accident is not considered credible in light of the low applied stresses and the inherent ductility of the piping material. The Reactor Materials Program was initiated to provide the technical basis for an alternate, credible design basis accident. The major thrust of this program is to develop an alternate maximum rate LOCA by deterministic means. Additionally, the probability of a DEGB is being determined; to show that in addition to being mechanistically implausible, a DEGB is also highly improbable. The probability of a DEGB of the piping has been evaluated in two parts: failure by direct means, and indirectly-induced failure. Failure by direct means can be credibly postulated to occur as an undetected crack grows to the point of instability, causing a large pipe break. Indirect failure of the piping can be triggered by an earthquake which causes other reactor components or the reactor building to fall on the piping or pull it from its anchor points. The indirect failure of the piping in K reactor is the subject of this report. 5 refs.

3017 **(EGG—2529) Historical summary of the fuel and waste handling and disposition activities of the TMI-2 Information and Examination Program (1980-1988).** Reno, H.W.; Schmitt, R.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1988. Contract AC07-76ID01570. 35p. NTIS, PC A03/MF A01. Order Number DE89002078/JAW.

This report is a historical summary of the major activities conducted by the TMI-2 Information and Examination Program in managing fuel and special radioactive wastes resulting from the accident at the Unit 2 reactor of the Three Mile Island Nuclear Power Station (TMI-2). The activities often required the development and use of advanced handling, processing, and/or disposal technologies for those wastes.

3018 **(EGG-M—88333) Achieving 95% probability level using best estimate codes and the code scaling, applicability and uncertainty (CSAU) [Code Scaling, Applicability and Uncertainty] methodology.** Wilson, G.E.; Boyack, B.E.; Duffey, R.B.; Griffith, P.; Katsma, K.R.; Lellouche, G.S.; Rohatgi, U.S.; Wulff, W.; Zuber, N. (EG and G Idaho, Inc., Idaho Falls (USA); Idaho National Engineering Lab., Idaho Falls (USA); Los Alamos National Lab., NM (USA); Massachusetts Inst. of Tech., Cambridge (USA); Levy (S.), Inc., Campbell, CA (USA); Brookhaven National Lab., Upton, NY (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1988. Contract AC07-76ID01570. 9p. (CONF-8808131—2). NTIS, PC A02/MF A01. Order Number DE88016946/JAW.

From Appendix K relief using best estimate method; Cambridge, MA, USA (11 Aug 1988).

Issue of a revised rule for loss of coolant accident/emergency core cooling system (LOCA/ECCS) analysis of light water reactors will allow the use of best estimate (BE) computer codes in safety analysis, with uncertainty analysis. This paper describes a systematic methodology, CSAU (Code Scaling, Applicability and Uncertainty), which will provide uncertainty bounds in a cost effective, auditable, rational and practical manner. 8 figs., 2 tabs.

3019 **(EGG-M—88334) Experimental data bases useful for quantification of model uncertainties in best estimate codes.** Wilson, G.E.; Katsma, K.R.; Jacobson, J.L.; Boodry, K.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-8808131—2). NTIS, PC A02/MF A01. Order Number DE88016947/JAW.

From Appendix K relief using best estimate method; Cambridge, MA, USA (11 Aug 1988).

A data base is necessary for assessment of thermal hydraulic codes within the context of the new NRC ECCS Rule. Separate effect tests examine particular phenomena that may be used to develop and/or verify models and constitutive relationships in the code. Integral tests are used to demonstrate the capability of codes to model global characteristics and sequence of events for real or hypothetical transients. The nuclear industry has developed a large experimental data base of fundamental nuclear, thermal-hydraulic phenomena for code validation. Given a particular scenario, and recognizing the scenario's important phenomena, selected information from this data base may be used to demonstrate applicability of a particular code to simulate the scenario and to determine code model uncertainties. LBLOCA experimental data bases useful to this objective are identified in this paper. 2 tabs.

3020 **(GA—A19455) The licensing experinece of the Modular High-Temperature Gas-Cooled Reactor (MHTGR).** Silady, F.A.; Cunliffe, J.C.; Walker, L.P. (General Atomics Co., San Diego, CA (USA)). Sep 1988. Contract AC03-88SF17367. 16p. (CONF-8809150—2). NTIS, PC A03/MF A01. Order Number DE88017341/JAW.

From IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors; San Diego, CA, USA (21 Sep 1988).

The MHTGR is an advanced reactor concept being developed under a cooperative program involving the US Government, the nuclear industry, and the utilities. The design utilizes the basic HTGR features of ceramic fuel, helium coolant, and a graphite moderator. However, the specific size and configuration are selected to utilize the inherent characteristics of these materials to develop passive safety features that provide a significantly higher margin of safety than current generation reactors. The design meets the US Environmental Protection Agency's Protective Action Guidelines at the site boundary, hence precluding the need for sheltering or vacation of the public during any licensing basis event. This safe behavior is not dependent upon operator action and is insensitive to operator error. The MHTGR Licensing Plan agreed to with the US Nuclear Regulatory Commission (NRC) is discussed with particular attention to the framework of the preapplication review. The objective and scope of each key document prepared for the NRC review is presented. A summary is provided of the safety response to events challenging the functions relied on to retain radionuclides within the coated fuel particles. The regulatory interaction process and results are discussed through the NRC staff, NRC contractor, and ACRS reviews. 11 refs., 3 figs.

3021 **(HEDL-SA—3624) A new safety approach in the design of fast reactors.** Neuhold, R.J.; Marchaterre, J.F.; Waltar, A.E. (Westinghouse Hanford Co., Richland, WA (USA)). [1987]. Contract AC06-87RL10930. 12p. (CONF-870917—9). NTIS, PC A03/MF A01. Order Number DE89001118/JAW.

From ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation; Richland, WA, USA (13 Sep 1987).

A new approach to achieving fast reactor safety goals is becoming really apparent in the US Fast Reactor Program. Whereas the "defense is best" philosophy still prevails, there has been a tangible shift toward emphasizing passive mechanisms to protect the reactor and provide public safety---rather than relying on add-on active, engineered safety systems. This paper reviews the technical basis for this new safety approach and provides discussion on its implementation in current US liquid metal-cooled reactor designs. 4 refs., 4 figs.

3022 **(HEDL-TME—84-19) Results and code predictions for ABCOVE [aerosol behavior code validation and evaluation] aerosol code validation: Test AB6 with two aerosol species.** Hilliard, R.K.; McCormack, J.C.; Muhlestein, L.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Dec 1984. Contract AC06-76FF02170. 428p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE87014147/JAW.

A program for aerosol behavior code validation and evaluation (ABCOVE) has been developed in accordance with the LMFBR Safety Program Plan. The ABCOVE program is a cooperative effort between the USDOE, the USNRC, and their contractor organizations currently involved in aerosol code development, testing or application. The second large-scale test in the ABCOVE program, AB6, was performed in the 850-m^3 CSTF vessel with a two-species test aerosol. The test conditions simulated the release of a fission product aerosol, NaI, in the presence of a sodium spray fire. Five organizations made pretest predictions of aerosol behavior using seven computer codes. Three of the codes (QUICKM, MAEROS and CONTAIN) were discrete, multiple species codes, while four (HAA-3, HAA-4, HAARM-3 and SOFIA) were log-normal codes which assume uniform coagglomeration of different aerosol species. Detailed test results are presented and compared with the code predictions for seven key aerosol behavior parameters.

3023 **(HEDL-TME—85-1) Results and code predictions for ABCOVE [aerosol behavior code validation and evaluation] aerosol code validation with low concentration NaOH and NaI aerosol: CSTF test AB7.** Hilliard, R.K.; McCormack, J.D.; Muhlestein, L.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1985. Contract AC06-76FF02170. 253p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE87014239/JAW.

A program for aerosol behavior validation and evaluation (ABCOVE) has been developed in accordance with the LMFBR Safety Program Plan. The ABCOVE program is a cooperative effort between the USDOE, the USNRC, and their contractor organizations currently involved in aerosol code development, testing or application. The third large-scale test in the ABCOVE program, AB7, was performed in the 850-m^3 CSTF vessel with a two-species test aerosol. The test conditions involved the release of a simulated fission product aerosol, NaI, into the containment atmosphere after the end of a small sodium pool fire. Four organizations made pretest predictions of aerosol behavior using five computer codes. Two of the codes (QUICKM and CONTAIN) were discrete, multiple species codes, while three (HAA-3, HAA-4, and HAARM-3) were log-normal codes which assume uniform coagglomeration of different aerosol species. Detailed test results are presented and compared with the code predictions for eight key aerosol behavior parameters. 11 refs., 44 figs., 35 tabs.

3024 **(IAEA-R—4303-F) Thermal hydraulic analysis of nuclear research reactors. Final report for the period January 1986 - January 1988.** Bartzis, J.G. (National Research Centre for the Physical Sciences Democritos, Athens (Greece)). (International Atomic Energy Agency, Vienna (Austria)). May 1988. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704186/JAW.

A loss of coolant accident (LOCA) can cause total or partial core uncovery which is followed by substantial fuel element temperature increase due to fuel residual heat. It is essential to demonstrate that such a temperature increase does not lead to excessive core melting and to significant radioactive material release into the reactor building and consequently to the environment. The THEAP computer codes able to perform reliable analysis of such accidents have been developed. THEAP-I is a computer code developed with the aim to contribute to the safety analysis of the MTR open pool research reactors. THEAP-I is designed for three dimensional, transient thermal/hydraulic analysis of a thermally interacting channel bundle totally immersed into water or air, such as the reactor core. The mathematical and physical models and methods of the solution are given as well as the code description and the input data. A sample problem is included, referring to the Greek Research Reactor analysis, under a hypothetical severe loss

of coolant accident. The micro computer version of the code is also described. More emphasis is given in the new features of the code (i.e. input data structure). A set of instructions for running in an IBM-AT2 computer with the microsoft FORTRAN V4.0 is included together with a sample problem referring to the Greek Research Reactor. THEAP-I can be used also for other MTR open pool research reactors. Refs and figs.

3025 **(INIS-GB—159) Statement of incidents at nuclear installations: fourth quarter 1987.** (Health and Safety Executive, London (UK)). 10 Jun 1988. 4p. Health and Safety Executive, Baynards House, 1 Chepstow Place, Westbourne Grove, London W2 4TF.

This statement reports briefly on two incidents at nuclear installations. A localized area of radioactive contamination was discovered adjacent to the wall of a waste storage silo at the Sellafield reprocessing plant and was traced to a defective pipe. There was no excessive exposure of personnel to radiation. In the second incident a process worker received a radiation dose to his hand higher than the permitted dose by 20%. Procedures for the safe removal of a component from a mixture-settler box in the Prototype Fast Reactor Fuel Reprocessing Plant at Dounreay has not been complied with. (U.K.).

3026 **(LA-UR—88-3158) TRAC code assessment using data from SCTF Core-III, a large-scale 2D/3D facility.** Boyack, B.E.; Shire, P.R.; Harmony, S.C.; Rhee, G. (Los Alamos National Lab., NM (USA)). [1988]. Contract W-7405-ENG-36. 12p. (CONF-8810169—1). NTIS, PC A03/MF A01. Order Number DE89000357/JAW.

From SFEN/NUCSAFE '88; Paris, France (2 Oct 1988).

Nine tests from the SCTF Core-III configuration have been analyzed using TRAC-PF1/MOD1. The objectives of these assessment activities were to obtain a better understanding of the phenomena occurring during the refill and reflood phases of a large-break loss-of-coolant accident, to determine the accuracy to which key parameters are calculated, and to identify deficiencies in key code correlations and models that provide closure for the differential equations defining thermal-hydraulic phenomena in pressurized water reactors. Overall, the agreement between calculated and measured values of peak cladding temperature is reasonable. In addition, TRAC adequately predicts many of the trends observed in both the integral effect and separate effect tests conducted in SCTF Core-III. The importance of assessment activities that consider potential contributors to discrepancies between the measured and calculated results arising from three sources are described as those related to (1) knowledge about the facility configuration and operation, (2) facility modeling for code input, and (3) deficiencies in code correlations and models. An example is provided. 8 refs., 7 figs., 2 tabs.

3027 **(NUREG/CR—5051) Detecting and mitigating battery charger and inverter aging.** Gunther, W.E.; Lewis, R.; Subudhi, M. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Aug 1988. Contract AC02-76CH00016. 119p. (BNL-NUREG—52108). NTIS, PC A06/MF A01 - GPO. Order Number TI89003011/JAW.

This report constitutes the second of the two-phase approach for assessing the safety and operational aspects of battery charger and inverter aging in nuclear power plants. This work, conducted by Brookhaven National Laboratory (BNL) under the auspices of the US NRC Nuclear Plant Aging Research (NPAR) Program, evaluated operating experience data, nuclear power plant maintenance practices, and plant design information to determine the impact of battery charger and inverter aging on safety, and the methods which should be used to detect aging degradation and mitigate its effects. A naturally aged inverter and battery charger were tested at BNL to evaluate the naturally aged condition, the effectiveness of condition monitoring techniques, and the practicality of implementing selected maintenance and monitoring recommendations. Temperature monitoring, component parameter measurements, and the periodic observation of critical circuit waveforms are viable methods for monitoring aging degradation. A maintenance program for battery chargers and inverters is recommended. As described in this report, the maintenance program incorporates inspection, monitoring, testing and repair activities which should be performed to detect and mitigate aging effects, and thereby assure the operational readiness of this important equipment throughout the plant's operating life. 32 refs., 43 figs., 19 tabs.

3028 **(NUREG/CR—5153) The leachability and mechanical integrity of simulated decontamination resin wastes solidified in cement and vinyl ester-styrene.** Soo, P.; Milian, L.W.; Piciulo, P.L. (Brookhaven National Lab., Upton, NY (USA)). May 1988. Contract AC02-76CH00016. 76p. (BNL-NUREG—52149). NTIS, PC A05/MF A01 - GPO. Order Number TI89002409/JAW.

The rate of release of organic decontamination reagents were measured for mixed-bed resins solidified in Portland cement and vinyl ester-styrene. The intent is to evaluate the effect of composite size on the release rate to determine if experiments on small laboratory samples can be used to predict the behavior of full size waste forms. The effects of chelating agents on the release of Co-60 from cementitious waste forms is addressed. Cracking during leaching was also investigated and reasons for its occurrence outlined. 26 refs., 32 figs., 13 tabs.

3029 **(NUREG/CR—5196) Submission for the CSNI/GREST benchmark exercise on chemical thermodynamic modeling in core-concrete interaction releases of radionuclides.** Powers, D.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 52p. (SAND—88-1920). NTIS, PC A04/MF A01 - GPO. Order Number TI89001877/JAW.

A submission for the CSNI/PWG-4/GREST standard problem on chemical thermodynamic modeling in core-concrete interaction releases of radionuclides is described. Part A of the exercise is a highly defined benchmark calculation in which data and speciation are specified. The problem is, however, ambiguous concerning the definition of an ideal solution. Consequently, two solutions are provided. In one solution, specified species are treated as molecular entities to define the ideal solution. In the second, mixing is assumed to occur ideally on cationic and anionic lattices. The different results obtained in these calculations illustrate the importance of condensed phase modeling in the analyses of high temperature melt interactions with concrete. Part B of the exercise consists of six problems in which the temperatures, pressures and bulk compositions of the melts are specified. Data and speciation are to be supplied as parts of the solutions to the problems. Results of calculations for these six problems are presented. Additional solutions are provided to illustrate the effects of speciation in the condensed oxide phase, non-ideality in the condensed metal phase and uncertainty in the thermodynamic properties of gas phase species. 17 refs., 14 tabs.

3030 **(NUREG/CR—5241) Development of programmatic performance indicators.** Olson, J.; Chockie, A.D.; Geisendorfer, C.L.; Vallario, R.W.; Mullen, M.F. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 161p. (PNL—6680; BHARC—700/88/022). NTIS, PC A08/MF A01 - GPO. Order Number TI89002739/JAW.

This report summarizes a series of analyses of available plant performance data to determine if the data can be used to construct indicators of performance for several important plant functions. Data concerning the backlog of generic safety issues, operator examination scores, causes of events, and repeat equipment failures are reviewed and analyzed. The analysis indicates that generic safety issue backlog data can be used to assess some aspects of management performance. Operator exam scores do not appear to constitute good summary measures of the quality of training. Licensee Event Reports were found to be codable through the Sequence Coding and Search System into meaningful and useful cause codes for assessing performance in several programmatic areas. Available data on repeat equipment failures were found to be inadequate for establishing a clear measure of maintenance performance. The report concludes that additional data are necessary to assure the

valid and reliable assessment of programmatic performance. 13 refs., 12 figs., 39 tabs.

3031 **(PB—88-870043/XAB) Nuclear power plant decommissioning. January 1972-September 1988 (Citations from the NTIS data base). Report for January 1972-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 103p. NTIS PC N01/MF N01.

This bibliography contains citations concerning nuclear power plant phase-out and decommissioning. Included are case histories of the dismantling process, hazardous-waste management, site monitoring, and economic aspects of the phase-out. (Contains 178 citations fully indexed and including a title list.)

3032 **(PNL-SA—15336) MLAM assessment of radionuclide air concentration and deposition for the Chernobyl reactor accident.** Davis, W.E.; Olsen, A.R.; Didier, B.T. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 15p. (CONF-880927—4). NTIS, PC A03/MF A01. Order Number DE89001731/JAW.

From 17. NATO/CCMS international technical meeting on air pollution modelling and its application; Cambridge, UK (19 Sep 1988).

This paper describes an analysis of the spatial and temporal patterns of air concentrations and depositions estimated for Europe by a multi-layer, three-dimensional, meso-alpha-scale model, MLAM. Information is provided on the atmospheric transport of the effluent plume from the damaged reactor, surface air concentrations, and wet and dry deposition. Numerous measurements were made after the accident, and in some countries the observations may be sufficient to determine general air concentration and deposition patterns. Where measurements are available, modeled values are compared with them. However, there are large areas in Europe where such measurements are not available, and it is in these areas that modeling provides additional aid in determining the impact of the accident. The purpose of the paper is to provide insight into areas of possible deposition where measurements are not available. 19 refs., 6 figs., 4 tabs.

3033 **(PNL-SA—15616) Decontamination technology assessment.** Allen, R.P.; Konzek, G.J.; Schneider, K.R.; Smith, R.I. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 4p. (CONF-880903—39). NTIS, PC A02/MF A01. Order Number DE89001727/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

This study identifies and technically assesses foreign decontamination and decommissioning (D and D) technology developments that may represent significant improvements over D and D technology currently available or under development in the United States. Technology need areas for nuclear power reactor decommissioning operations were identified and prioritized using the results of past light water reactor (LWR) decommissioning studies to quantitatively evaluate the potential for reducing cost and decommissioning worker radiation dose for each major decommissioning activity. Based on these identified needs, current foreign D and D technologies of potential interest to the US were identified through personal contacts and the collection and review of an extensive body of D and D literature. These technologies were then assessed qualitatively to evaluate their uniqueness, potential for a significant reduction in D and D costs and/or worker radiation dose, development status, and other factors affecting their value and applicability to US needs. 4 refs.

3034 **(SAND—88-2253C) Use of expert judgment in NUREG--1150.** Ortiz, N.R.; Wheeler, T.A.; Meyer, M.A.; Keeney, R.L. (Sandia National Labs., Albuquerque, NM (USA); Los Alamos National Lab., NM (USA); University of Southern California, Los Angeles (USA)). 1988. Contract AC04-76DP00789. 24p. (CONF-8810155—2). NTIS, PC A03/MF A01. Order Number DE89001850/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The expert judgment process used in NUREG--1150, "Severe Accident Risks: An Assessment for Five US Nuclear Plants," is an advance over those processes developed in previous probabilistic risk assessments. The new process was used to obtain expert judgment on issues expected to be the main contributors to the potential risk of five nuclear plants. The use of expert judgment helped to incorporate both the experience and the research results obtained since the Reactor Safety Study (US NRC, 1975). The new process also enabled NUREG--1150 to include a comprehensive uncertainty analysis, an analysis that had been lacking in the earlier Reactor Safety Study. This process for gathering expert judgment was developed in response to criticisms applied to the previous Reactor Safety Study by the Lewis Committee (Lewis, 1978) and to review comments of the Kouts Committee (1987) on the draft NUREG--1150. The process is based on accepted decision analysis techniques and findings from the numerous studies involving the quantification of judgment. The result, a formal process for eliciting and documenting expert judgment for risk assessment, is one of the major contributions of NUREG-1150. 19 refs., 5 figs., 1 tab.

3035 **(UJV—7891-T) Testing of FRAS code for thermal and mechanical calculations of light water reactor fuel elements in accident states.** Pazdera, F. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Sep 1987. 30p. (In Czech). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704313/JAW.

Computer code FRAS was used in calculating three experiments simulating reactivity accidents and two simulations of fuel element behavior during a LOCA. The calculations are mainly meant for comparison with other computer codes. (author). 31 figs., 19 tabs., 5 refs.

3036 **(WHC-SA—0206) Source term and shielding calculations to support decommissioning of Shippingport reactor.** Morford, R.J.; Bunch, W.L.; Carter, L.L.; Daughtry, J.W.; Schwarz, R.A.; Stinson, W.P. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 13p. (CONF-880906—11). NTIS, PC A03/MF A01. Order Number DE89001913/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

An experimental pressurized light-water reactor was operated at Shippingport, Pennsylvania from 1957 to 1982 to generate power for a public utility. The facility is being decommissioned and the reactor vessel, neutron shield tank, and radioactive internal hardware will be shipped by barge for burial on the Hanford site in Washington state. Shipping regulations require that the radioisotope inventory of the package be defined and that radiation dose rates be predicted for normal and accident conditions. Monte Carlo calculations and actual gamma-ray measurements were made to support the design of the package and preparation of paper work for the shipment. Calculational methods are described together with the results. 12 refs., 5 figs., 1 tab.

3037 **(WHC-SA—0209) Status of research on key LMR [liquid-metal-cooled reactor] safety issues.** Waltar, A.E.; Deitrich, L.W. (Westinghouse Hanford Co., Richland, WA (USA); Argonne National Lab., IL (USA)). Mar 1988. Contract AC06-87RL10930. 43p. (CONF-8710279—3). NTIS, PC A03/MF A01. Order Number DE89001163/JAW.

From US/USSR joint committee meeting on experimental data and studies of core accident conditions; Argonne, IL, USA (21 Oct 1987).

This paper presents a review of research on key US reactor safety issues in liquid-metal-cooled reactors (LMRs) over the past decade. The discussion is structured into two time domains: 1) the FFTF/CRBRP era, which featured a mixed oxide fuel system, and 2) the present era which emphasizes passive safety and a renewed emphasis on metal fuel. Issues in the FFTF and CRBRP era include local fault tolerance, core energetics potential (in response to unprotected transient overpower, loss of flow, or loss of heat sink events), and containment considerations. Issues of current interest focus much more heavily on reactivity feedbacks capable of preventing the core from entering into a state of disruption {endash} even for very low probability postulated events. Overall, the R&D over the past decade has provided generally favorable answers to safety concerns expressed in the early days of LMR design. Furthermore, the more recent programmatic directions {endash} which

emphasize passive safety {endash} provide even stronger assurances that LMRs can be built which are exceptionally robust. 75 refs., 4 figs., 2 tabs.

3038 **(WHC-SA—0307) A passive automated personnel accountability system for reactor emergency preparedness.** Zimmerman, R.O.; DeLisle, G.V.; Hickey, E.E. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 3p. (CONF-880913—8). NTIS, PC A02/MF A01. Order Number DE89002144/JAW.

From ANS topical meeting on emergency response: planning, technologies and implementations; Charleston, SC, USA (26 Sep 1988).

In 1985 a project was undertaken at the N Reactor on the Hanford Site to develop an automated personnel accountability system to ensure accountability of all personnel within 30 minutes of a site evacuation. The decision to develop such a system was made after a full-scale evacuation drill showed that the manual accountability system in use at the time was inadequate to meet the 30-minute requirement. Accountability systems at commercial nuclear power plants were evaluated, but found to be unsuitable because they were not passive, that is, they required action on part of the user for the system to work. Approximately 2500 people could be required to evacuate the 100-N Area. Therefore, a card key system or badge exchange system was judged not to be feasible. A passive accountability system was desired for N Reactor to allow personnel to enter and leave the site in a more timely manner. To meet the need for an automated accountability system at N Reactor, a special Evacuation Accountability System (EVACS) was designed and developed. The EVACS system has three basic components: the transponder, a credit card-sized device worn with the security badge; portal monitors, which are electronically activated by the transponder; and a computer information system that contains the personnel data base. Each person wearing a transponder is accounted for automatically by walking through a portal. In this paper, a description of the hardware and software will be presented, together with problems encountered and lessons learned while adapting an existing technology to this particular use. The system is currently installed and requires acceptance testing before becoming operational.

3039 **Modeling and analysis of BWR severe accidents.** Kim, S.H. Troy, NY; Rensselaer Polytechnic Institute (1987). 324p. University Microfilms Order No. 87-29,311.

Thesis (Ph. D.).

A state-of-the-art computer model was developed for the analysis of severe accidents in Boiling Water Reactor (BWR) nuclear power plants. This model includes a broad spectrum of phenomena for both in-vessel and ex-vessel thermal hydraulics. This report presents models for: BWR core degradation, heatup and failure of the lower core-support plate, and containment-system response. In specific, it includes models for core heat transfer, power generation, debris formation, molten material relocation, metal-steam interaction, fuel dissolution, disintegration of the core-support plate, various mechanisms of steam removal in the containment, chemical reaction (e.g., H_2 or CO burning), and intercompartment flows in the containment. All the models were numerically implemented as a computer code, APRIL.MOD2. The APRIL.MOD2 code was tested and used to study hypothetical BWR core meltdown accidents for various scenarios. The results of the APRIL.MOD2 calculations are presented.

25 ENERGY STORAGE

2506 Thermal

3040 **(PNL-SA—15937) Performance evaluation of aquifer thermal energy storage.** Drost, M.K.; Reimers, E. (Pacific Northwest Lab., Richland, WA (USA); USDOE, Washington, DC). May 1988. Contract AC06-76RL01830. 21p. (CONF-881013—1). NTIS, PC A03/MF A01. Order Number DE89002005/JAW.

From JIGASTOCK '88; Versailles, France (18 Oct 1988).

The performance characteristics of aquifer thermal energy storage (ATES) systems have proved to be difficult to compare because data from separate field tests cannot necessarily be correlated. This paper presents a performance evaluation methodology that establishes a comprehensive and consistent set of performance figures-of-merit and a consistent method of comparing the performance of different ATES systems. The comparison procedure uses techniques commonly used in electrical and electronic engineering to define performance. The method is demonstrated by application to the ATES experiment at the University of Minnesota in St. Paul, Minnesota, USA. 4 refs., 6 figs., 5 tabs.

2509 Batteries

REFER ALSO TO CITATION(S) 2924

3041 **(AD-A—196997/1/XAB) Corrosion phenomena during overcharge in polymer-electrolyte cells. Technical report No. 19, 15 July 1985-30 May 1988.** Munchi, M.Z.; Gopaliengar, R.; Owens, B.B. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). 19 May 1988. 26p. NTIS, PC A03/MF A01.

The corrosion behavior of the polymer-electrolyte cell was investigated using various surface analytical techiques. The results indicate that, under normal-cycling conditions, the cell components are perfectly intact with no evidence of any corrosion. However, cells placed on overcharge for prolonged periods showed and inability to discharge.

3042 **(AD-A—196998/9/XAB) Lithium secondary batteries: role of polymer-cathode morphology. Technical report No. 20, 15 July 1985-30 May 1988.** Naoi, K.; Osaka, T.; Owens, B.B. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). Jun 1988. 2p. NTIS, PC A02/MF A01.

Electrically conducting polymers have been utilized both as the cathode and as the electrolyte element of Li secondary cells. Polymer cathodes were limited in their suitability for batteries because of the low energy content associated with low levels of doping and the inclusion of complex ionic species in the cathode. Recent studies have indicated that doping levels up to 100% can be achieved in polyanilene. High doping levels in combination with controlled morphologies have been found to improve the energy and rate capabilities of polymer cathodes. A morphology-modifying technique was utilized to enhance the charge/discharge characteristics of Li/liquid electrolyte polypyrrole cells. The polymer is electropolymerized in a preferred orientation morphology when the substrate is first precoated with an insulating film of nitrile butadiene rubber (NBR). Modification of the kinetic behavior of the electrode results from variations in the chemical composition of the NBR.

3043 **(N—88-28109) Effect of compression on individual pressure vessel nickel/hydrogen components.** Manzo, M.A.; Perez-Davis, M.E. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Aug 1988. 12p. (NASA-TM—101312; E—4305; NAS—1.15:101312; CONF-880702—). NTIS, PC A03/MF A01.

From 23. intersociety energy conversion engineering conference; Denver, CO, USA (31 Jul 1988).

Compression tests were performed on representative Individual Pressure Vessel (IPV) Nickel/Hydrogen cell components in an effort to better understand the effects of force on component compression and the interactions of components under compression. It appears that the separator is the most easily compressed of all of the stack components. It will typically partially compress before any of the other components begin to compress. The compression characteristics of the cell components in assembly differed considerably from what would be predicted based on individual compression characteristics. Component interactions played a significant role in the stack response to compression. The results of the compression tests were factored into the design and selection of Belleville washers added to the cell stack to accommodate nickel electrode expansion while keeping the pressure on the stack within a reasonable range of the original preset.

3044 **(PB—88-235882/XAB) Corrosion control in alkali metal-oxyhalide systems. Final report.** Walsh, F. (Tracer Technologies, Inc., Somerville, MA (USA)). 30 Sep 1985. 47p. NTIS, PC A03/MF A01.

The rate of lithium and calcium anode corrosion and surface film formation were measured at elevated temperature (70C) in $SOCl_2$- and SO_2Cl_2-based electrolytes in the presence and the absence of selected valve metal salts. The resistance, capacitance, and apparent film thickness of the passivating film were determined using a galvanostatic transient technique. The addition of the valve metal salt was observed to reduce anode corrosion rate by at least a factor of three and as much as a factor of 50, increase the rate of passivating-film growth by a factor of three, and improve the performance of the anodes in laboratory cells.

3045 **(PB—88-869284/XAB) Thermal batteries. January 1970-September 1988 (Citations from the NTIS data base). Report for January 1970-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 111p. NTIS PC N01/MF N01.

Supersedes PB—87-864146.

This bibliography contains citations concerning a class of reserve-type molten-salt-eletrolyte primary cell systems (thermal batteries) that are inert until brought into use by the ignition of a charge of pyrotechnics or raised to their operating temperature by a conventional heating means. The battery remains active for hours or only a few seconds, depending on size, thermal insulation, electrochemical system, ambient temperature, and rate at which power is withdrawn. Various eletrochemical systems are discussed and include, calcium, magnesium, and lithium compounds. Design, development, fabrication, and accelerated age testing of thermal batteries are presented. Applications in weapons systems as the primary power source for navigation and igniter systems are discussed. (This updated bibliography contains 197 citations, 53 of which are new entries to the previous edition.)

3046 **(PB—88-869946/XAB) Battery electrolytes. May 1983-September 1988 (Citations from the COMPENDEX data base). Report for May 1983-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 177p. NTIS PC N01/MF N01.

Supersedes PB—87-856985.

This bibliography contains citations concerning the design, construction and applications of solid, liquid, and gaseous battery electrolytes. Electrolyte properties and battery performance, maintenance, and safety are considered. (This updated bibliography contains 350 citations, 60 of which are new entries to the previous edition.)

29 ENERGY PLANNING AND POLICY

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 2794, 2894, 3057, 3101, 3109

3047 **(CONF-8702160—1) Economic global competitiveness and scientific global cooperation.** Postma, H. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89001675/JAW.

From International conference on radiation dosimetry and safety; Taipei, Taiwan (27 Feb 1987).

The economy of every country is being strongly influenced by two major and rapidly evolving forces. One is the global nature of economic competitiveness and the second is the strong degree to which this Competitiveness depends upon technology. It is possible that this increasing global economic competitiveness could clash with the strong tradition of global cooperation in science; yet we need to strengthen global scientific cooperation. The increasing complexity and costs of research and development, the rapid pace at which it is evolving and the extraordinary promise for creating better living conditions rests upon increasing cooperation. It is the purpose of my talk to examine these two forces---the increasing competitiveness in economic goods and the compelling need for increasing global cooperation in scientific undertakings.

3048 **(DOE/CE/64608—T1) Third-Party Financing guide: South Carolina.** (South Carolina State Government, Columbia (USA)). Jun 1988. Contract FG01-86CE64608. 100p. NTIS, PC A05/MF A01. Order Number DE89002694/JAW.

Institutional buildings present a unique opportunity and challenge to federal and state energy efficiency programs. The barriers to conservation in these public buildings often include a cumbersome purchasing and decision making process, centralized energy payment procedures, and, most importantly, a continuing shortage of up-front funds for capital improvement projects. Providing a detailed description of the concept of a private sector Third-Party Financing mechanism for energy conservation capital improvements in public buildings is the purpose of this manual. The US Department of Energy has provided a grant to the State of South Carolina under the Developmental State Program for Institutional Conservation. The grant, FG01-86CE64608, was awarded to the State of South Carolina through a competitive solicitation by DOE among the several states and territories. Announced as a Tier I Grant under the Institutional Conservation Program, the program was conceived as a means of funding innovative state projects designed to incorporate non-federal resources into the continuing federal energy conservation strategy of improving the energy efficiency of the nation's public and private non-profit institutional buildings. The South Carolina project was one of twelve receiving awards to further the innovative development of state-sponsored activities.

3049 **(EPRI-EA/EM—3597-Vol.5) Demand-side management: Volume 5, Industrial markets and programs: Final report.** Blevins, R.P.; Broehl, J.H.; Fassbender, L.L.; Miller, B.A.; Skelton, J.C.; Friedman, N.R.; Davis, T.D.; Khosla, N.K. (Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Div., OH (USA); Resource Dynamics Corp., Vienna, VA (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA); Enviro-Management and Research, Inc., Springfield, VA (USA)). Mar 1988. 284p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003008/JAW.

Cosponsored by EPRI and EEI, this five-volume series on demand-side management (DSM) has developed a unified planning framework to address seemingly divergent utility activities, such as load management, conservation, rate innovation, and marketing. Volume 1 of this series discusses several key issues involved in planning, evaluating, implementing, and monitoring DSM activities. Volume 2 addresses the techniques involved in evaluating DSM alternatives that are suitable for a given utility. The evaluation tools described range from the simplest intuitive approaches to detailed computer modeling systems. Volumes 3, 4 and 5 discuss available hardware options and marketing alternatives that are suitable for the residential, commercial, and industrial sectors, respectively. Volume 3 also includes a series of 40 technical briefs that provide concise summaries of selected residential technology options. Volume 4 includes a series of 21 commercial technical briefs and Volume 5 includes 21 industrial technical briefs. Volume 5 also includes industry profiles containing energy use and business outlook information for each of the 20 2-digit SIC groups making up the manufacturing sector.

3050 **(UCRL—21129) The LLNL/UC Davis Dialogue Project: Final report.** Craig, P. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1988. Contract W-7405-ENG-48. 4p. NTIS, PC A02/MF A01. Order Number DE89002649/JAW.

The LLNL/UC Davis Dialogue Project grew out of a desire by staff at LLNL and by faculty and students at UC Davis to engage in an extended discussion over a broad spectrum of issues associated with the nuclear arms race. The project operated over a period of three years. During this time meetings were held approximately each month during the academic year. Meetings alternated between Livermore and Davis, and were occasionally held at a suitable location halfway between the two. The project was jointly sponsored by LLNL and by the University of California Institute on Conflict and Cooperation.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 3058, 3130, 3133, 3532, 3533, 3535, 3536, 3537, 3538, 3553, 3554, 3555, 3556, 3557, 3581, 3582, 3583, 3655, 3656, 3657, 3658, 3673

3051 (AD-A—196512/8/XAB) Installation-restoration program. Phase 2. Confirmation/quantification. Stage 1. Hancock Field, New York and HQTAC, Langley AFB, Virginia. Final report. (JRB Associates, Inc., McLean, VA (USA)). Oct 1984. 215p. NTIS, PC A10/MF A01.

Phase I was completed at Hancock Field, New York, in July 1982. This study, conducted by Engineering-Science, Inc., identified and prioritized past disposal sites that could pose a threat to public health or the environment through contaminant migration. The Phase II (Stage 1) at Hancock Field consisted of a preliminary environmental survey to confirm the presence of any environmental contamination that has resulted from waste-disposal practices. This report presents the results of the Phase II (Stage 1) survey. Hazardous materials, Wastes.

3052 (ORAU—88/C-125) Trade instructional materials for SARA/OSHA training: Volume 1: General site worker training. (Oak Ridge Associated Universities, Inc., TN (USA); Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-76OR00033;AC05-84OR21400. 517p. NTIS, PC A22/MF A01; 1; GPO Dep. Order Number DE88015039/JAW.

This document is the first in a new line of TRADE resources designed to provide DOE and contractor training personnel with the tools needed to meet steadily increasing training requirements. The interim final rule, 29 CFR 1910.120, issued by the Occupational Safety and Health Administration (OSHA) in compliance with the Superfund Amendments and Reauthorization Act (SARA), requires that workers at operations involving hazardous waste treatment, storage, and disposal receive 24 hours of training describing techniques for worker protection and the health effects of hazardous materials. The training requirements in the proposed rule published on August 10, 1987, are substantially the same as those in the interim final rule. The training required by this rule is different from training required by the Environmental Protection Agency through the Resources Conservation and Recovery Act (RCRA) which deals with procedures for handling waste materials. The SARA/OSHA training focuses on informing workers about the health hazards within their facilities and how to minimize them. The instructional materials in this volume were originally developed by the Technical Resources and Training Program Staff at Oak Ridge National Laboratory (ORNL) to provide 24 hours of initial training to hazardous waste treatment, storage, and disposal facility workers as required by OSHA 29 CFR 1910.120. ORNL determined that these materials met the criteria for the 24 hour training requirement after an extensive needs analysis of related regulations and their application to the hazardous waste sites within the laboratory.

3053 (PB—88-247242/XAB) Review of research in support of extrapolation models by EPA's (Environmental Protection Agency's) Office of Research and Development. Final report. (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). May 1987. 55p. (SAB/EC—87/030). NTIS, PC A04/MF A01.

The report's major finding is that there is no overall, conceptually integrated Environmental Projection Agency (EPA) research program on extrapolation modeling, but a conglomeration of investigator-initiated projects, many of which are commendable in their de ign and implementation. The major recommendation is that EPA should develop a comprehensive plan for an extrapolation models research program that should: articulate an overall conceptual objective towards which individual projects would aim; enhance EPA's risk assessment-risk management philosophy; develop a framework that promotes more planning and resource stability in support of the research; provide a common nomenclature; improve communication among the Agency's organizational components; and explain to the nonscientist how the research on extrapolation models supports the Agency's regulatory decisions.

2904 Natural Resources

REFER ALSO TO CITATION(S) 3271, 3567

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 2931, 3058, 3088, 3093, 3106, 3112, 3139, 3355, 3359

3054 (AD-A—196250/5/XAB) Naval Research Laboratory 1986 review. (Naval Research Lab., Washington, DC (USA)). 1986. 303p. (NRL-PUB—0104-2630). NTIS, PC A14/MF A01.

Original contains color plates: All DTIC/NTIS reproductions will be in black and white.

Highlights of NRL Research in 1986 include: Structures were identified for a novel class of antimalarial drugs having a new type of silver coordination; glass fibers having an optical loss of 0.9dB/km at 2.5 microns, with a potential for 0.01 dB/km, were produced from zirconium, barium, lanthanum, aluminum, and sodium fluorides as a replacement for silica glass in long-length glass communication links; a new monotonic Lagrangian gird tracking algorithm was developed to provide rapid access of computerized data on the near neighbors of any object in many-body systems ranging from battlefield scenarios to molecular dynamics simulations of biological arrays; effects of the sea-air temperature differential and wind stress on radar backscatter were determined through both airborne and sea-surface measurements; NRL's airborne geophysical sensor suite was used in the remote detection of anomalies in magnetic and gravity fields caused by the earth's crustal variations beneath the ice-covered Weddell Sea; a system was designed and tested to measure radiation effects on integrated circuits; power transistors and solid-state transmitter architectures for wideband high-power shipboard radars were developed; surface acoustic wave chemical microsensors were shown to discriminate between CW agents and begnign species; a diode-pumped nonneodymium rare-earth laser based on the 2.1-micron holmium transition was demonstrated. A high-energy density pulser was developed.

3055 (CONF-8612153—Absts.) Proceedings of the Historically Black Colleges and Universities (HBCU) Research Seminar: Final report. (Grambling State Univ., LA (USA); USDOE Pittsburgh Energy Technology Center, PA). 1986. Contract FG22-86PC90503. 150p. NTIS, PC A08. Order Number DE88013802/JAW.

From Historically black colleges and universities (HBCU) research seminar; Grambling, LA, USA (9 Dec 1986).

For the first time, a Science Research Seminar was planned primarily to encourage facility in HBCU undergraduate institutions to actively and vigorously pursue federal funding to participate in projects of national interest. The seminar proved to be unique in many ways. Grant administrators from the Departments of Energy, Department of Defense, NASA, and EPA spoke of the grant opportunities specially for minorities in science and technology. Scientists and researchers from HBCU faculty spoke on the problems, limitations and possible solutions in promoting research in Historically Black Colleges and Universities (HBCU's). Scientific presentations on on-going research in fossil energy were made by Federal researchers and HBCU faculty. More than thirty HBCU faculty members made poster presentations on research plans and facilities at their institutions. These proceedings consist of copies of both oral and poster presentations made by the attending scientists and program officers of the Department of Energy, Department of Defense, NASA and EPA. Included in the Appendix are the program agenda, HBCU Research Association Draft Proposal, list of contact persons at Pittsburgh Energy Technology Center for further guidance in the development of research proposals, and directory of the invited HBCU scientists.

3056 **(INIS-GB—153) Harwell directory of technology. A guide to Harwell's R and D facilities and services.** (UKAEA Harwell Lab.). Feb 1988. 69p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754745/JAW.

The Directory of Technology series of leaflets (10 in this folder) provides comprehensive information on the research and development facilities and expertise available at the Harwell laboratory of the United Kingdom Atomic Energy Authority. Each leaflet covers a field of technology and lists the Business Centres and related customer services offered. The leaflets are Process and Chemical Engineering Technology, Materials Technology, Evaluation and Monitoring Techniques and Instrumentation, Computing Science and Applications, Environmental, Medical and Analytical Sciences, Nuclear Engineering, Reactor Materials Behaviour and Safety Research, Radioactive Waste Management and Disposal, Nuclear Fuels Processing and Isotopes, Major Nuclear research and development facilities. There is a cross-referenced index which provides information to enable contact to be made with the appropriate business centre manager. (U.K.).

3057 **(PB—88-246442/XAB) Commercializing high-temperature superconductivity.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Jun 1988. 172p. (OTA-ITE—388). NTIS, PC A08/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card no. 88-600535.

The special report begins with a look at U.S. strengths and weaknesses in technology development and commercialization, both in general and for HTS. The analysis then goes on to the strategies of U.S. and Japanese companies, as managers in each country look ahead to the new opportunities. The fourth chapter presents 20 policy options for congressional consideration; the context is U.S. technology policy as a whole, with HTS as a special case. Most of the policy options deal, in one way or another, with the management of the Federal R&D budget. Chapter 5, the last, considers three broad alternatives for speeding commercialization.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 2792, 2793, 2834, 2972

3058 **(EML—512) Environmental Measurements Laboratory: Annual report, calendar year 1987.** de Planque, E.G.; Hardy, E.P. Jr.; Chieco, N.A. (ed.). (Department of Energy, New York (USA). Environmental Measurements Lab.). Oct 1988. 188p. NTIS, PC A09/MF A01. Order Number DE89002249/JAW.

In 1987 Annual Report contains a series of short descriptions of each of the projects in which we were actively engaged. These technical summaries are grouped by broad programmatic headings under the organizational units of the Laboratory. Following the summaries, there are listings of the Laboratory's seminar program, staff activities, publications, publications in progress, and presentations. While the summaries generally appear in the principal investigator's division or branch section of the report, many of the projects are multi-organizational and are noted as such by the addition of all participants names, as well as by a system of cross referencing.

3059 **(NUREG—0750-Vol.28-No.2) Nuclear Regulatory Commission issuances.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Aug 1988. 269p. NTIS, PC A10/MF A01 - GPO. Order Number TI89002500/JAW.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 2941, 3060, 3105

2910 Conservation

REFER ALSO TO CITATION(S) 3048, 3081, 3093, 3098, 3099, 3100, 3101, 3106

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 2779, 2801, 3083

3060 **(DOE/EIA—0202(88/4Q)) Short-term energy outlook: Quarterly projections, October 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 3 Nov 1988. 56p. NTIS, PC A04/MF A01 - GPO. Order Number DE89002417/JAW.

Total demand for petroleum in the United States appears to be on track for recording another year of strong growth, with total oil demand for all of 1988 likely to average above 17 million barrels per day for the first time since 1980. The expected 2.0-percent growth this year can be attributed to a combination of low world oil prices, adverse weather conditions, and a buoyant economy. Next year, if the assumptions of slightly higher oil prices (on average), normal weather, and a decelerating economy hold, noticeably slower growth in petroleum use (and other energy sources) is expected for the United States. This year's strong increase in electricity use may not be closely matched in 1989 if the weather returns to the normal, hence milder, temperatures assumed in this report. However, industrial use of electricity continues to exhibit robust growth, and this sector should lead overall electricity use to record levels again in 1989. 18 figs., 18 tabs.

3061 **(IEE—8801) Actual condition and forecast of demand on energy for business use. How far does demand for business use increase.** Usuki, Syoji; Onozaki, Tamotsu. (Institute of Energy Economics, Tokyo (Japan)). 25 Feb 1988. 50p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754959/JAW.

Regarding to the question of 'how far does the demand on energy for business use increase', past record was studied to give a prediction for the future. The major factors which may vary the scale of demand for business-use energy seem to be the original unit of energy requirement and the floor space. Energy saving factors and energy increasing factors were investigated. During the period from 1986 to 2000, it is estimated that the rate of increase in the floor space will slow down to 2.5 % while the amount of energy demand per unit floor space may turn to increase. The increase of the total energy demand in business is estimated to be about 3.9 % in the future. This indicates that the direction of the change in the original unit turns towards upward from the previous downward direction, resulting in the structural change of energy demand in business. (47 figs, 12 tabs)

3062 **(WHC-EP—0069) Micro Grid: A needs assessment technique for educational and emergency preparedness programs.** Zimmerman, R.O. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 131p. NTIS, PC A07/MF A01. Order Number DE89001893/JAW.

This study identifies the differences among three groups in their response to eleven key program areas of emergency preparedness. Responses to a needs assessment technique, terms a "Micro Grid," was used to determine the differences among senior company leaders and those who would be involved in an emergency response situation. Senior company leaders from Westinghouse Hanford Company and the Emergency Control Center staffs and Building Emergency Directors on the Hanford Site in Richland, Washington were selected as subjects. The Micro Grid Worksheet on Emergency Preparedness was developed, tested, and taken by 100% of the 392 survey participants. The resulting nonparametric data were organized into three groups, Building Emergency Direc-

tors, Emergency Control Center staffs, and Senior company leaders. The Median Test for Independent Samples was utilized to interpret the data. 56 refs., 3 figs., 19 tabs.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 2834, 2947, 3048, 3050, 3052, 3058

3063 **(K/DSRD—53) Foreign Affairs Information System (FAIS) Early Operational Capability (EOC) network security criteria.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 12 Sep 1988. Contract AC05-84OT21400. 19p. NTIS, PC A03/MF A01. Order Number DE89001452/JAW.

The Joint Center for Information Security Technology (JCIST) at Oak Ridge, Tennessee, under an interagency agreement between the Department of State (DOS) and the Department of Energy (DOE), has been tasked with the security certification testing of the Foreign Affairs Information system (FAIS) Early Operational Capability (EOC) software. The basis for this certification is the FAIS (EOC) Security Requirements Allocation (SRA) document. This document defines the security requirements for the FAIS EOC software. Security certification of the FAIS system is the responsibility of the Office of Information Systems Security, Bureau of Diplomatic Security (DS/ST/ISS). The overall FAIS EOC certification will be completed in two general steps. First, a test of a stand-alone FAIS EOC system against the SRA requirements which is currently in progress. Second is a test of all FAIS network system interfaces against the SRA requirements as expanded to adequately address the network security issues. This accumulation of requirements is referred to as the FAIS EOC Network Security Criteria. 5 refs.

3064 **(NUREG—1272-Vol.2-No.2) Report to the US Nuclear Regulatory Commission on Analysis and Evaluation of Operational Data, 1987: Nonreactors.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Oct 1988. 79p. (AEOD/S—804-Vol.2-No.2). Q/MF A01 - GPO. Order Number TI89002247/JAW.

This annual report of the US Nuclear Regulatory Commission's Office for Analysis and Evaluation of Operational Data (AEOD) is devoted to the activities performed during 1987. The report is published in two volumes. NUREG-1272, Vol. 2, No. 1, covers Power Reactors and presents an overview of the operating experience of the nuclear power industry, with comments regarding the trends of some key performance measures. The report also includes the principal findings and issues identified in AEOD studies over the past year, and summarizes information from Licensee Event Reports, the NRC's Operations Center, and Diagnostic Evaluations. NUREG-1272, Vol. 2, No. 2, covers Nonreactors and presents a review of the nonreactor events and misadministration reports that were reported in 1987 and a brief synopsis of AEOD studies published in 1987. Each volume contains a list of the AEOD reports issued for 1980-1987.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 2779, 2784, 2784, 2792, 2793, 2795, 2796, 2801, 3060, 3112

2960 Electric Power

REFER ALSO TO CITATION(S) 2792, 2793, 2794, 2938

3065 **(AD-A—196614/2/XAB) Engineering evaluation and analysis for the improvement of military standard generators. Final report, June-31 July, 1987.** Lemieux, L.N. (VSE Corp., Alexandria, VA (USA)). 31 Jul 1987. 73p. (VSE/EPPSG—0076-87/26RDVOl-1). NTIS, PC A04/MF A01.

This report presents the analyses and design of specific modifications to the MIL Standard Diesel-Engine-Driven (DED) generator sets (15, 30, and 60 kW). Design improvements targeted towards improving reliability and maintainability are presented. Heavy-duty slides were added to the battery tray to allow an extension of 12 in. out from the existing design. Tee handle latches have been selected to improve door sealing after repeated use. Soft isolation mounts were selected to withstand the impact of an 8-mph rail impact. The throttle was relocated to the control panel to facilitate noise-attenuation modifications. A low coolant impedance sensor was added to the set to prevent damage to the set from operation with low coolant levels. Use of a different engine-exhaust muffler for reduced sound signatures has an accompanying new exhaust-outlet location and orientation (vertical). After evaluation of manufacturers' engine data obtained during a market surveillance, the Hercules D3400-T engine was recommended for installation & testing as a replacement engine for the 60 KW DED set. Modifications resembling the Regency Net Sound attenuation design were adapted to the 15-, 30-, & 60-kW DED sets. These modifications include sound insulation, engine air intake silencer, engine exhaust muffler, and cooling-air intake and exhaust baffling.

3066 **(AD-A—196615/9/XAB) Engineering evaluation and analysis for the improvement of military standard generators. Volume 1. Final report, 24 February-29 May 1987.** Adolph, R.J.; Lawrence, L.G.; Perkins, G.W.; Thorwaldson, E. (VSE Corp., Alexandria, VA (USA). Army Systems Group). 29 May 1987. 279p. (VSE/ASG—0067-87/18RDVOL-1). NTIS, PC A13/MF A01.

This Final Report provides an in-depth look at on-going projects for improving the Mobile Electric-Power-Generating System (MEPGS) sets. A detailed comparison of existing MEPGS requirements for generators against proposed requirements for commercial generators procured for tactical military use is presented. From this comparison, a list of areas and characteristics of the MEPGS sets, which fall short of the requirements imposed by the draft Required Operational Capability (ROC) document are presented. Major areas include: noise, reliability, Electro Magnetic Pulse (EMP), and built-in test equipment. This report analyzes industry response and suggestions for improvement of the MPEGS set family. Respondents' suggestions fell primarily in the areas of Reliability, Noise and Infrared (IR) suppression. The majority of recommended actions were general in nature, but the vendors were consistent in the areas they felt could be improved. Design modifications are proposed for all MEPGS sets considered in this study to upgrade the requirements in the areas of noise suppression and reliability. Major emphasis is placed on improvements to the 15-, 30-, and 60-kW generator sets.

3067 **(AD-A—196993/0/XAB) Engineering evaluation and analysis for the improvement of military standard generators. Volume 2. Final report, 24 February-29 May 1987.** Adolph, R.J.; Lawrence, L.G.; Perkins, G.W.; Thorwaldson, E. (VSE Corp., Alexandria, VA (USA)). 29 May 1987. 204p. (VSE/ASG—0067-87/18RD-VOL-2). NTIS, PC A10/MF A01.

See also Volume 1, AD-A196 615.

Contents include: noise kits for 15- and 30-kW generator sets; Mil-Std generator set towed assemblage; electromagnetic pulse (EMP) analysis on the electromagnetic control system of the Mep-114A 30-kW DED generator set; technical data sheet - solar electric-battery charger; technical data sheet - diesel fuel heater/water separator; Patriot fuel-waxing study of the 15- and 30-kW Mil-Std generator sets; Photos-Regency net (modified 15 kW) sound suppressed generator set towed assemblage; battery charger for EMU-30 generator set.

3068 **(CRIE-Y—87008) Future developments of diversification of electric utilities. Comparative study of public utilities.** Iguchi, Norio. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). 10 Mar 1988. 33p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754958/JAW.

To find out future developments on the diversification in electric power industry, the comparative studies on public enterprises in Japan such as gas, railway, and telecommunication business were carried out. As the results, it was concluded as follows: (1) A motive and an objective for the diversification in electric power industry is not different essentially from that of general private enterprises. The diversification has several functions to support

the principal occupation, and it would be important managerial strategy and measures to get over recent severe administrative conditions. (2) Regulations on the diversification in electric utilities are most strict, consequently, it is required that the restrictions in electric utilities are relaxed like railway business law to open the way for the diversification keeping their public situation. (8) In electric power industry, thero are enough rooms for the diversification, several kinds of services could be accepted as new diversified services. (5 figs, 10 tabs, 23 refs)

3069 **(MLM—3545) A study on the feasibility of fabricating miniature compressed magnetic field current generators and the effects on generator efficiency.** Pugh, B.K.; Leeman, J.E. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 30 Sep 1983. Contract AC04-76DP00053. 68p. NTIS, PC A04/MF A01. Order Number DE89002467/JAW.

The feasibility of fabricating efficient miniature compressed magnetic field (CMF) current generators was investigated. Four small CMF generators 0.5 to 14 cm^3 were built and tested at Mound. They were reduced from a previously tested generator chosen as the baseline size. A scaling factor of S = 2/3 was used to proportionately reduce the linear dimensions of each generator to the next smaller size. These devices were tested with uniformly scaled electrical loads, and the output currents generated by the devices were observed. From these output currents the peak energies delivered to the loads were calculated and compared to the initial energy inputs to measure efficiency. The feasibility of fabricating miniature CMF generators was demonstrated, although some efficiency was lost and performance was not as uniform as desired. Additional studies with tighter dimensional tolerances will be performed in an attempt to resolve these problems. 12 refs., 13 figs., 8 tabs.

3070 **(PB—88-869672/XAB) Homopolar motors and generators. January 1975-September 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 104p. NTIS PC N01/MF N01.

Supersedes PB—86-861556.

This bibliography contains citations concerning design, analysis, construction, testing, and applications of homopolar motors and generators. Energy storage for nuclear fusion and industrial welding facilities are discussed. Applications of homopolar motors in transportation are presented. Topics also include magnetic circuit analysis, superconducting windings, and environmental testing. (This updated bibliography contains 213 citations, 47 of which are new entries to the previous edition.)

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 2792, 2793, 2794, 2795, 2796, 3097, 3102

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 2909

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

3071 **(DOE/ET/10815—124) Magnetohydrodynamics Coal-Fired Flow Facility: Quarterly technical progress report, January--March 1988.** (Tennessee Univ., Tullahoma (USA). Space Inst.). Oct 1988. Contract AC02-79ET10815. 21p. (UTSI—88-03). NTIS, PC A03/MF A01. Order Number DE89001753/JAW.

UTSI reports on work under a multi-task development program directed toward development of the technology for the Steam Bottoming Plant of a Combined Cycle MHD/Steam Power plant. During this period a POC test was conducted and results are reported. This test was conducted with careful control of the potassium carbonate seed flow rate to avoid excess quantities so that most of the potassium in the convective heat transfer components and downstream was in the form of potassium sulfate. The results were encouraging insofar as capability to keep the tube surfaces clean enough to avoid excess pressure drop. The ESP performance was also exceptionally good, apparently due to the absence of significant amounts of potassium carbonate, and it was concluded that the ESP will adequately handle a higher flow rate (higher SCA) in future tests. Plans are discussed to modify the superheater test module to provide more flexibility in achieving desired test conditions in future tests. Modifications to the upstream components, that are required to simulate the MHD topping cycle for testing of the downstream, to improve their reliability are reported. Results of application of advanced diagnostics equipment by both UTSI and Mississippi State University are summarized. Reports of other activities, including studies and analyses, operations and maintenance of the CFFF facility and environmental activities are included. 1 fig., 1 tab.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 3041, 3044

3072 **(DOE/PC/79931—T2) Oxygen electrode in molten carbonate fuel cells: Fourth quarterly technical progress report, May 1--July 31, 1988.** Dave, B.; Adanuvor, P.K.; White, R.E.; Enayetullah, M.A.; Srinivasan, S.; Appleby, A.J. (Texas A and M Univ., College Station (USA)). 1988. Contract FG22-87PC79931. 14p. NTIS, PC A03/MF A01. Order Number DE89002264/JAW.

The high temperature apparatus for investigations of electrode kinetics of oxygen reduction on test electrodes in molten carbonates was tested using Li_2CO_3 melt and a gold flag test electrode. Potential sweep data for oxygen reduction reaction at the gold electrode in Li_2CO_3 melt were obtained and the results were found to be in agreement with the available data in literature. AC impedance measurements, as a function of frequency, are in progress to evaluate the kinetic parameters for peroxide reduction in Li_2CO_3 melt. A complex nonlinear least square parameter estimation program, based on equivalent circuit model, is employed to analyze the ac impedance data. One of the designs being considered for the microelectrode [to be used to determine the transport parameters of the intermediate species (O_2^- and O_2^{2-}) and the electrode kinetic parameters for oxygen reduction in molten carbonates] is a fine wire (diameter of 25 μm or less) anchored on an alumina tube with a ceramic adhesive. This design is being initially tested for oxygen reduction in an aqueous medium. For this purpose, a cylindrical microelectrode of gold is being used in aqueous KOH solution for the simultaneous determination of diffusion coefficient and solubility of oxygen from the transient measurements of the potential step experiments. Several ceramic adhesives are being evaluated for their stability in molten carbonate environment. The stable ceramic adhesive will be utilized for leak-proof sealing of the test electrode (fine wire) to the open end of the alumina tube. 9 figs.

3073 **(N—88-27267) Alkaline fuel cell performance investigation.** Martin, R.E.; Manzo, M.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Aug 1988. 10p. (NASA-TM—100937; E—4217; NAS—1.15:100937; CONF-880702—). NTIS, PC A02/MF A01.

From 23. intersociety energy conversion engineering conference; Denver, CO, USA (31 Jul 1988).

An exploratory experimental fuel cell test program was conducted to investigate the performance characteristics of alkaline laboratory research electrodes. The objective of this work was to establish the effect of temperature, pressure, and concentration upon performance and evaluate candidate cathode configurations having the potential for improved performance. The performance characterization tests provided data to empirically establish the effect of temperature, pressure, and concentration upon performance for cell temperatures up to 300 F and reactant pressures up to 200 psia. Evaluation of five gold alloy cathode catalysts revealed that three doped gold alloys had more that two times the surface

areas of reference cathodes and therefore offered the best potential for improved performance.

3074 **Electrolytic cell stack with molten electrolyte migration control.** Kunz, H.R.; Guthrie, R.J.; Katz, M. (to Dept. of Energy, Washington, DC). US Patent 4,761,348. 2 Aug 1988. Filed date 17 Mar 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an electrolytic cell stack including a plurality of electrolytic cells with electrically conductive, electrolyte impermeable separator sheets between adjacent cells in the stack, the electrolytic cells including a porous anode member, a porous cathode member and a porous matrix for molten electrolyte disposed in the stack between major surfaces of the anode and cathode members. The stack has a negative end portion and a positive end portion at opposite ends thereof with the edge surfaces of the cells forming a first stack face for admitting a supply of oxidant gas and the edge surfaces forming a second stack face for admitting a supply of fuel gas, porous sealing means at the outer margins of the first stack face and at the outer margins of the second stack face for sealing to the supply of oxidant gas and to the supply of fuel gas.

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3201 Buildings

3075 **(AD-A—196408/9/XAB) Simplified characterization of HVAC system design on building energy use. Master's thesis.** Reardon, M.K. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 183p. (AFIT/CI/NR—88-79). NTIS, PC A09/MF A01.

A significant portion of the energy in the United States today is used for comfort cooling and heating. Fifteen or twenty years ago, when energy was inexpensive, there was little economic pressure for engineers to provide an energy efficient facility design. In recent years, energy-efficiency has become a significant consideration in the design of a new facility. To aid in the design effort, many computer programs have been developed to predict energy use. The complexity of these programs has made them difficult to use and not readily accessible to the practicing engineer. The objective of this work is to develop a simple tool for characterizing facility energy consumption as a function of the space loads, the HVAC system, and control method selected and appropriate equipment parameters.

3076 **(ANL—88-36) Laboratory tests in support of Atmospheric Fluidized-Bed Cogeneration Air Heater Experiment: Summary report.** Natesan, K.; Podolski, W. (Argonne National Lab., IL (USA)). Jul 1988. Contract W-31109-ENG-38. 109p. NTIS, PC A06/MF A01. Order Number DE89002534/JAW.

The Atmospheric Fluidized-Bed Cogeneration Air Heater Experiment (ACAHE), sponsored by the US Department of Energy (DOE), is intended to assess the performance of various heat exchanger materials in order to establish confidence in the resultant designs of fluidized-bed combustion air heater systems. Westinghouse Electric Corporation is preparing specifications and hardware for the ACAHE. Argonne National Laboratory, through a contract with the Rocketdyne Division of Rockwell International, will conduct the tests in the DOE 6-ft {times} 6-ft atmospheric fluidized-bed combustion facility in El Segundo, California. A laboratory test program (involving six tests) has been conducted to evaluate the corrosion behavior of several metallic alloys, coatings, claddings, and weldments in support of the ACAHE experiment. Five of the six tests were conducted at a metal temperature of 871{degree}C, while the sixth test had a metal temperature of 635{degree}C. The gas temperature in all the tests was 899{degree}C. Detailed information is also presented on the corrosion scale morphologies, scale compositions and thicknesses, intergranular penetration of the substrate material, and metal recession. These tests have provided corrosion information on a variety of ASME-coded and noncoded structural materials under a well-characterized laboratory test environment simulating the atmospheres in bubbling- and circulating-bed combustors. 5 refs., 84 figs., 16 tabs.

3077 **(CONF-870620—12) Steady-state refrigerant flow and airflow control experiments conducted on a continuously variable speed air-to-air heat pump.** Miller, W.A. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 25p. NTIS, PC A03. Order Number DE89001931/JAW.

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

A continuously variable speed air-to-air split-system residential heat pump of nominal 2 3/4-ton (9.7-kW) capacity was instrumented and tested in the laboratory. The coefficient of performance (COP), capacity of the system, and component efficiencies were measured during steady-state heating- and cooling-mode operation. The indoor blower speed and the refrigerant subcooling at the condenser exit were varied at discrete compressor speeds to determine best COP as constrained by residence comfort requirements. Heating- and cooling-mode test results showed a 10% improvement in COP for operation with a variable area throttle as compared with a capillary tube throttle. Improved control of refrigerant flow and reduction of the indoor blower speed improved humidity control. As compared with results for capillary tube flow control, the sensible heat ratio was reduced from 0.95 to 0.77 at 15-Hz compressor speed. 6 refs., 12 figs., 2 tabs.

3078 **(CONF-881210—4) Development of a gas fired heat pump with an improved absorption cycle.** Phillips, B.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02. Order Number DE89000648/JAW.

From ASME winter annual meeting; Chicago, IL, USA (1 Dec 1988).

An investigation is underway to develop air-to-air, gas fired, absorption heat pumps of higher efficiency, by the use of one of the advanced absorption cycles. The program is directed toward residential size equipment. The generator-absorber heat exchange cycle was found to be significantly more practical for the application than others. A preliminary cost estimate indicated the potential equipment price to be competitive with existing heating plus cooling equipment. Experimentally, a breadboard test unit reached its goal of a cycle coefficient of performance of 1.9 in heating mode at the 47{degree}F (8.3{degree}C) ARI test conditions. Outdoor testing of an assembled heat pump and development of components and a prototype heat pump are under way. A related investigation of new refrigerant/absorbent combination determined that the fluid has improved performance capabilities but serious corrosion problems. 4 refs., 8 figs.

3079 **(DOE/CE—0222-Vol.1) COSTSAFR 3.0---User's manual: (Conservation Optimization Standard for Savings in Federal Residences): In support of proposed modifications to interim energy conservation standards for new federal residential buildings.** (Department of Energy, Washington, DC (USA). Office of Buildings and Community Systems). Jun 1988. 95p. NTIS, PC A05/MF A01. Order Number DE89001633/JAW.

This document describes how to use the computer program developed under the Federal Residential Standard Project funded by the Department of Energy. The computer program provides an analysis of specific housing projects at a given site, using alternative fuel types, and considering alternative housing types. Designed around the concept of minimizing overall costs through energy conservation design--including first cost and future utility costs--the computer program establishes a standard design to which proposed housing designs are compared. It then provides a point table, for each housing type, that can be used to determine whether a proposed design meets the standard and how a design could be modified to meet the standard. The computer program has been designed for IBM-PC or compatible computers and is recorded on a floppy disk. This manual describes how to use the program and how to read the information that appears on the screen during program operation. It describes the inputs required and the various options presented to the user. The appendices provide more detailed information related to the output produced by the program. This output consists of point tables presenting points for each energy conservation option, and a point total that must be met to comply

with the standard. The technical support document and economic analysis are separate documents that provide more information about the specifics of the standard.

3080 **(DOE/CE—0222-Vol.2) Supplementary technical support document, In support of proposed modifications to interim energy conservation standards for new Federal residential buildings.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Building Systems Div.). Jun 1988. 19p. NTIS, PC A03/MF A01. Order Number DE89001710/JAW.

Pacific Northwest Laboratory is conducting research to expand and improve the interim energy standards for Federal residential buildings. This consists primarily of the development of data for thermal mass walls and the creation of new window data, including low-emissivity (low-E) glazing. These new data are incorporated in Version 3 of the software COSTSAFR. For complete details on the technical approach used in development of the standards, see the Technical Support Document; In Support of Proposed Interim Energy Conservation Standards for New Federal Residential Buildings, July 1986. 3 refs., 3 tabs.

3081 **(DOE/CE/64614—T1) Nebraska public buildings energy program: A comprehensive approach to energy conservation in public and institutional buildings: Final report.** (Nebraska Energy Office, Lincoln (USA)). Jul 1988. Contract FG01-86CE64614. 328p. NTIS, PC A15/MF A01. Order Number DE89002034/JAW.

In 1986, the Nebraska Energy Office received a Tier 1 planning grant through the Institutional Conservation Program of the US Department of Energy to develop a comprehensive program to increase energy efficiency in institutional sector buildings. The Energy Office developed the Nebraska Public Buildings Energy Program, which addresses the energy needs of hospitals, schools, local government buildings, state buildings, public care facilities and nonprofit institutions. This report summarizes the work of the Nebraska Energy Office. It has a threefold purpose: to present a comprehensive description of the program; to serve as a model for developing similar programs in other states; to underscore the message that energy efficiency is both necessary to efficient government operations and costs less than developing new resources to meet energy needs. 20 figs.

3082 **(DOE/USDA—21697/1) Thermal properties of wood and wood panel products for use in buildings.** TenWolde, A.; McNatt, J.D.; Krahn, L. (Oak Ridge National Lab., TN (USA); Forest Service, Madison, WI (USA). Forest Products Lab.). Sep 1988. Contract AC05-84OR21400. 55p. (ORNL/Sub—87-21697/1). NTIS, PC A04/MF A01. Order Number DE89002488/JAW.

This report provides a review and evaluation of currently available information on the thermal conductivity and specific heat of wood building materials. We derived a linear equation for thermal conductivity of solid wood as a function of density and moisture content from data in the literature and used this to provide estimated conductivity values for various types of hardwoods and softwoods. Far fewer data exist for the thermal conductivity of wood panel products. Current design values appear to be based on the premise that the conductivity of plywood is the same as that of solid wood of the same species, but the few reported results from measurements indicate a lower conductivity. More definitive information exists on the conductivity of conventional particleboard and fiberboard, but additional conductivity measurements of plywood and some of the most commonly used flakeboards, such as oriented strandboard (OSB), are needed. Additional measurements of the specific heat are needed for all wood panel products. We discuss special problems of measuring thermal properties of wood products with high moisture contents and the practical relevance of such data to building design and performance, and we conclude that thermal properties above fiber saturation are of little practical significance. The report contains the authors' recommendations for design values for thermal properties and for further research and additional measurements, as well as a bibliography. 33 refs., 14 figs., 10 tabs.

3083 **(EPRI-EA/EM—3597-Vol.4) Demand-side management: Volume 4: Commercial markets and programs: Final report.** Blevins, R.P.; Broehl, J.H.; Fassbender, L.L.; Miller, B.A.; Skelton, J.C.; Davis, T.D.; Khosla, N.K. (Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Div., OH (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA); Enviro-Management and Research, Inc., Springfield, VA (USA)). Sep 1987. 124p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003007/JAW.

Cosponsored by EPRI and EEI, this five-volume series on demand-side management (DSM) has developed a unified planning framework to address seemingly divergent utility activities, such as load management, conservation, rate innovation, and marketing. Volumes 3, 4 and 5 discuss available hardware options and marketing alternatives that are suitable for the residential, commercial, and industrial sectors respectively. This document: Volume 4, includes a series of 21 commercial technical briefs.

3084 **(EPRI-EM—6062) Ground-source and hydronic heat pump market study: Final report.** Goldish, L.H.; Simonelli, R.A. (Electric Power Research Inst., Palo Alto, CA (USA); Technical Marketing Associates, Inc., Sudbury, MA (USA)). Nov 1988. 291p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002802/JAW.

A market study of ground source heat pumps and hydronic heat pumps is presented. Equipment characteristics, performance and functional suitability are discussed. Buyer behavior and the distributor/dealer/installer infrastructure reviewed. The market potential is analyzed as a function of performance and incremental installed cost. Implications for both product and market development are presented. 132 figs.

3085 **(LBL—23581) An indices approach for evaluating the performance of fenestration systems in nonresidential buildings.** Sullivan, R.; Arasteh, D.; Papamichael, K.; Kim, J.J.; Johnson, R.; Selkowitz, S.; McCluney, R. (Lawrence Berkeley Lab., CA (USA)). Nov 1987. Contract AC03-76SF00098. 19p. (CONF-880627—6). NTIS, PC A03/MF A01. Order Number DE89002674/JAW.

From ASHRAE annual meeting; Ottawa, Canada (25 Jun 1988).

We present results from the first phase of a project to develop a fenestration performance design tool to be used by builders, designers, architects, utility auditors, etc. In phase 1 we defined the design tool concept and the experimental and analytical methodologies required to achieve the project goal. We defined five fenestration performance indices, which when combined with user- specified weighting factors yield a single figure of merit. Three of the indices are related to the effects of fenestration on building energy performance: fuel and electric use and peak electric demand. The other two are related to thermal and visual comfort. We derived index values and correlations to window design parameters by creating a data base consisting of a large number of building energy simulations for a prototypical office building module using the DOE-2 computer simulation program. Four glazing types and two shading devices were combined in several ways so that a representative sampling of realistic fenestration systems was analyzed. 9 refs., 10 figs.

3086 **(ORNL/Sub—86-47985/2-V1) Free-piston Stirling engine diaphragm-coupled Heat-Actuated Heat Pump component technology program: Volume 1, Phase 2A and 2B final report: Technical discussion.** Ackermann, R.A. (Oak Ridge National Lab., TN (USA); Mechanical Technology, Inc., Latham, NY (USA)). 25 Jan 1988. Contract AC05-84OR21400. 263p. (MTI—88TR9-Vol.1). NTIS, PC A12/MF A01. Order Number DE89001953/JAW.

This report presents the results of an effort to develop and demonstrate the technical feasibility of a residential size Stirling-engine-driven diaphragm-coupled compressor for a heat pump application. The heat pump module consists of a 3-kW free-piston Stirling engine (FPSE), an efficient hydraulic transmission, and a nominal 3-ton capacity refrigerant (R-22) reciprocating compressor.

During earlier Phase 1 activity, the lower end (hydraulic transmission and compressor) was designed, fabricated, mated to an existing Mechanical Technology Incorporated (MTI) FPSE, and tested. After several years of development, this heat pump module achieved a capacity of 2.5 refrigeration tons at 95{degree}F ambient conditions. While this was below the module's rated 3.0-ton capacity, it demonstrated the potential of the FPSE heat pump (FPSE/HP) and identified a lack of engine power as the main reason for the low capacity. During a companion engine development program sponsored by the Gas Research Institute, the engine was improved by developing a new displacer drive that increased the FPSE's power capability. During Phase 2, the new engine, the Mark I, was mated to the lower end (transmission/compressor) and tested. The testing of the Mark I FPSE/HP module was very successful, with the system achieving its 3.0-ton capacity goal and all other proof-of-concepts targets. Included herein is a discussion of the Phase 2 activity, including the results of the Mark I FPSE/HP module testing, a component design effort of several key lower end components that was performed to optimize the design, and the Lennox evaluation. 91 figs., 36 tabs.

3087 **(ORNL/Sub—86-47985/2-V2) Free-piston Stirling engine diaphragm-coupled Heat-Actuated Heat Pump component technology program: Volume 2, Phase 2A and 2B final report: Lennox test program.** Ackermann, R.A. (Oak Ridge National Lab., TN (USA); Mechanical Technology, Inc., Latham, NY (USA)). 25 Jan 1988. Contract AC05-84OR21400. 281p. (MTI—88TR9-Vol.2). NTIS, PC A13. Order Number DE89001954/JAW.

This volume addresses the testing of the Mark I heat pump module conducted by Lennox Industries. The following information is contained herein: Lennox Test Plan; Lennox Test Data Spread Sheet; Lennox Parametric Test Data Plots; and Lennox Parametric Test Data Sheets.

3088 **(ORNL/TM—10760) The National Fuel Gas End-Use Efficiency Field Test: Experimental plan.** Ternes, M.P.; Hu, P.S. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 117p. NTIS, PC A06/MF A01. Order Number DE89001955/JAW.

The National Fuel Gas End-Use Efficiency Field Test will be performed to (1) determine the performance and cost-effectiveness of a new audit-directed retrofit procedure, and (2) develop and validate analysis techniques for evaluating conservation programs that can use the daily house gas use data that can be economically collected by gas telemetering equipment. The audit procedure is designed to improve conservation programs by including mechanical system retrofits as retrofit options in addition to building envelope retrofits, determining the most cost-effective retrofits for each house through individual analysis, and following a rational decision process to determine the investment level of each house. This report is an experimental plan presenting a detailed description of the audit procedure, specific research goals and questions to be addressed by the field test, the responsibilities of the six field test participants, 16 tasks required to complete the field test, a detailed description of the experimental design, house selection and assignment procedures, a detailed description of the data to be collected and the instrumentation to collect it, a data management procedure to store the data and check it for errors, and analysis procedures to be employed to study the collected data. 15 refs., 12 figs., 3 tabs.

3089 **(PB—88-250576/XAB) Heat pump and appliance research: research status report, 1987-1988.** (Gas Research Inst., Chicago, IL (USA)). Sep 1988. 122p. (GRI—88/0228). NTIS, PC A06/MF A01.

See also PB—88-102462.

This report details the status of projects within GRI's Heat Pump and Appliance Research Department. The strategy and objectives for these project areas are described along with contract status reports: residential heating and cooling systems, residential heat pump and prime-mover research, commercial heat pump and prime mover research, residential appliances, commercial appliances, and building-systems research.

3090 **(PB—88-869961/XAB) Thermal insulation for Buildings. September 1982-September 1988 (Citations from the COMPENDEX data base). Report for September 1982-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 120p. NTIS PC N01/MF N01.

Supersedes PB—86-868320.

This bibliography contains citations concerning materials used for the thermal insulation of buildings. Consumer acceptance of materials and weatherproofing options are included. Insulation in new and retrofitted buildings is discussed. Residential buildings, earth sheltered structures, greenhouses, and animal houses are among the structures studied. Infrared thermal sensing of heat loss, insulation placement, multilayer partition walls, and insulating windows are briefly considered. (This updated bibliography contains 244 citations, 92 of which are new entries to the previous edition.)

3091 **(PNL-SA—15600) A proposed method for improving residential heating energy estimates based on billing data.** Lee, A.D.; Hadley, D.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 15p. (CONF-8809103—5). NTIS, PC A03/MF A01. Order Number DE89001740/JAW.

From 5. annual symposium on improving building energy efficiency in hot and humid climates; Houston, TX, USA (13 Sep 1988).

Analyses of residential energy conservation programs frequently require reliable estimates of program effects on space-heating energy consumption. Simulation models are often used to provide such estimates. Recent, large-scale programs to collect empirical energy consumption data, however, provide a basis for alternative ways to estimate program effects that utilize the empirical data. The PRISM methodology uses relatively inexpensive billing and weather data to estimate base and temperature-sensitive (primarily space-heating) loads. We used billing data from over 300 manufactured (mobile) homes in two residential conservation projects to derive PRISM heating energy estimates. Actual heating energy data for a subset of these homes was used to develop a methodology for adjusting the initial PRISM-based heating estimates. We developed the adjustment relying on a theoretical approach and the empirical data. This approach resulted in a correction technique that reduced the average error in the initial PRISM-based space-heating estimates by about 70%, and requires primarily readily available PRISM outputs and limited housing characteristics data. 9 refs., 1 fig., 4 tabs.

3092 **(PNL-SA—16037) Estimating the market penetration of residential cool storage technology using economic cost modeling.** Weijo, R.O.; Brown, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 10p. (CONF-8809103—8). NTIS, PC A02/MF A01. Order Number DE89001733/JAW.

From 5. annual symposium on improving building energy efficiency in hot and humid climates; Houston, TX, USA (13 Sep 1988).

This study estimated the market penetration for residential cool storage technoiogy using economic cost modeling. Residential cool storage units produce and store chill during off-peak periods of the day to be used during times of peak electric power needs. This paper provides projections of unit sales expected in 5-year intervals for the years 1995, 2000, 2005, and 2010. Such projections help to determine the maximum amount of energy that could be displaced by this technology in the future. This study also found that price incentives offered to households must be varied dramatically by region for residential cool storage systems to be economically competitive relative to conventional systems. Under the most likely scenario, this analysis estimated that residential cool storage units will eventually capture about one-half of the central air conditioning (A/C) market. 14 refs., 2 figs., 8 tabs.

3093 **(EPRI-P—4463-SR-Vol.2-Pt.2) TAG{trademark} Technical Assessment Guide: Volume 2, Electricity end use: Part 2, Commercial electricity use, 1988.** Haas, S.M.; Lee, A.G.; Khosla, N.; Wilcox, B.; Isaksen, L. (Electric Power Research Inst., Palo Alto, CA (USA); Decision Focus, Inc., Palo Alto, CA (USA); XENERGY, Inc., Lexington, MA (USA); Enviro-Management and Research, Inc., Washington, DC (USA); Berkeley Solar Group, CA (USA); Analysis and Control of Energy Systems, Inc., Martinez, CA (USA)). Oct 1988. 369p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002435/JAW.

This Technical Assessment Guide (TAG{trademark}), prepared by EPRI personnel, has been compiled for the use of EPRI staff and its contractors to provide a common basis for evaluating electric energy R&D alternatives. This edition of the TAG{trademark} divides the document into four volumes. Volume 2. Technical Assessment Guide{endash}Electricity End Use. Evaluation procedures and data on technologies that use electricity as well as those using other forms of energy. Divided into three parts covering the residential, commercial, and industrial sectors. Describes the levelized annual cost method for making comparisons among technologies from the end-user's point of view.

3094 **Mixed convection heat transfer in a passive solar building.** Kirkpatrick, A.T.; Hill, D.D. (Colorado State Univ., Fort Collins (USA)). *Solar Energy;* **40**: No. 1, 25-34(1988).

Convective heat transfer through apertures such as doorways can be an important process by which thermal energy is transferred from one zone to another zone of a building. In this article, interzonal natural and forced convection in a two- and a three-zone, full-scale building are examined. Aperture velocity and temperature distributions are measured and the experimental interzonal mass flow rate and heat transfer are determined. A model based on zone temperature distributions is derived to predict the interzonal mass flow rate and heat transfer. The measured and predicted interzonal flow rate and heat transfer are compared and found to be in good agreement.

3095 **Adiabatic air dehumidification in laminar flow desiccant matrices.** Pesaran, A.A. (Solar Energy Research Institute, Golden, CO (US)). pp 31-40 of Solar energy technology. Murphy, L.M.; Guven, H.M.; Lowrey, P. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871234—).

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

Adiabatic step transient heat- and mass-transfer and pressure drop experimental data were obtained for a dehumidifier test matrix that contained microbead-silica-gel desiccant in a parallel-plate geometry. The data were analyzed and compared with the results of two other test dehumidifiers: a parallel-plate matrix using crushed silica gel, and a staggered, parallel-strip matrix using microbead silica gel. The analysis showed that the overall heat- and mass-transfer Nusselt numbers of the staggered, parallel-strip matrix were about 70% to 80% larger than those of the parallel-plate matrices. It also showed that the solid-side resistance to moisture diffusion in the smaller microbead silica gel was about 45% less than that of crushed silica gel because the particle size was 60% smaller. The ratio of heat- or mass-transfer coefficient to pressure drop of the microbead-silica-gel staggered, parallel-strip matrix was higher than the other two test dehumidifiers. Based on these findings, a dehumidifier using microbead silica-gel in a staggered, parallel-strip geometry can be made more compact than the other combinations.

3202 Transportation

REFER ALSO TO CITATION(S) 3651

3096 **(NAL-TR—946) Fabrication and test of a carbon-carbon composite combustion chamber for a low thrust storable engine.** Kusaka, Kazuo; Ueda, Shuichi; Abe, Noboru; Miyajima, Hiroshi; Kuwahara, Takuo; Kosaka, Katsuaki; Nagashima, Ryuichi. (National Aerospace Lab., Chofu, Tokyo (Japan)). Oct 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754961/JAW.

Injectors for a 2000 N thrust class, fuel film cooled, NTO (N_2O_4)/MMH (CH_3HNNH_2) propellant were fabricated. A carbon-carbon composite (C/C) combustion chamber was fabricated and the combustion tests were conducted. The energy release efficiencies of the core injectors were 95.5% with 15% film cooling and 92.5% with 25% film cooling. The vacuum specific impulse predicted for an injector with 15% film cooling with a 200:1 area ratio nozzle was 310 sec, and the injector indicated same level of performance compared with a gas pressurized type engine. No resonance combustions were observed. In the firing test of 90 sec cumulative duration, it was shown that the basic C/C composite material had sufficient high-temperature strength and that the SiC coating on the inner wall was durable at the operating conditions. The outside carbon CVD coating seemed to be effective in shutting off the permeability of the combustion gases. However, the heat resistant coating was necessary to protect the carbon CVD layer from oxidizing atmosphere under atmospheric pressure. (29 figs, 8 tabs, 10 refs)

3097 **(ORNL—6496) Light-duty vehicle MPG and market shares report: First six months of model year 1988.** Hu, P.S.; Williams, L.S. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 238p. NTIS, PC A11/MF A01. Order Number DE89001138/JAW.

This issue of Light-Duty Vehicle MPG and Market Shares Report: First Six months of Model Year 1988 reports the estimated sales-weighted fuel economics, sales, and market shares of automobiles and light trucks on a make and model basis, from model year 1976 to the first six months of model year 1988. This is the first time that data for model years 1976, 1977 and 1987 are published in this report series. Vehicle sales data are used as weighting factors in the sales-weighted estimation procedure. This enables the estimates to reflect averages for the overall new vehicle fleet. Comparisons and observations are highlighted on the trends in these vehicle characteristics from one model year to the next. Comparisons are also made on the fuel economy changes to determine the factors which have caused the changes. 3 refs., 30 figs., 37 tabs.

3098 **(PB—88-239686/XAB) New organizational responses to the changing transit environment.** Weigle, T.G.; Dyer, J.; Ringo, P.J.; Wilson, N.H.M.; Alter, J. (National Research Council, Washington, DC (USA). Transportation Research Board). 1988. 122p. (TRB/SR—217). NTIS, PC A06/MF A01.

The conference on new organizational responses to the changing transit environment, held in Norfolk, Virginia, December 2-4, 1987, was intended to review the effectiveness of various organizational options and strategies, analyze the institutional structures within which transit agencies operate, and explore the compatibility of organizational options and operating environments. Participants assessed the responses of transit agencies to the changing environment, the effectiveness of the different forms of transit organization, and probable future trends. The report contains the findings of the conference and six of the resource papers that served as a point of departure for the workshop discussions.

3099 **(PB—88-239892/XAB) HRIS (Highway Research Information Service) Abstracts. Volume 20, Number 3 - Fall 1987.** (National Research Council, Washington, DC (USA). Transportation Research Board). 1987. 327p. NTIS, PC A15/MF A01.

See also PB—88-193685. Library of Congress catalog card no. 75-642521.

HRIS Abstracts is a quarterly publication that provides information about highway and nonrail mass-transit research. It is compiled from computer records of the Highway Research Information Services (HRIS), an important subfile of the Transportation Research Information Services (TRIS) data base. Each issue consists of four sections: Abstracts of research reports; Source Index; Author Index; and Retrieval Term Index.

3100 **(PB—88-240684/XAB) Bus-maintenance analysis study. Final report.** Lederer, B.A.; MacDorman, L.C.; Schwager, D.S. (Watson, Rice and Co., Washington, DC (USA)). Jul 1988. 64p. NTIS, PC A04/MF A01.

The primary objective of the study was to identify performance indicators that may be used to identify transit systems with superior bus-maintenance performance. A literature review was conducted to identify factors often reported as affecting maintenance performance. A data base containing as many of the reported factors as available was created using 1984 UMTA Section 15 information. The methodological procedures used in the study are based upon the approach used by Fielding in his work for UMTA to develop indicators and peer groups for overall transit performance analysis. The study's work (as was Fielding's) was limited by the lack of a comprehensive data base from which to extract significant information relevant to the research. Such limitations may have a direct bearing on the validity and industry acceptance of the results.

3101 **(PB—88-241484/XAB) Estimating the cost impacts of transit-service contracting. Final report.** Teal, R.F.; Giuliano, G.; Golob, J.M.; Alexander, T.; Morlok, E.K. (California Univ., Irvine (USA)). Dec 1987. 255p. NTIS, PC A12/MF A01.

This study reports the results of an analysis of the potential cost impacts of private-sector-service contracting by transit agencies as well as the results of a nationwide survey of the magnitude and characteristics of existing transit-service contracting. Using cost models developed during the study, an evaluation was made of the cost impacts of contracting out 5 to 20% of the existing services of 19 medium and large transit agencies, and all service of 3 small agencies. The evaluation determined that large agencies would save 2 to 49% of the costs of the contracted service, with a mean savings of 28%, and that medium size agencies would save up to 31% of the cost of service they contracted, with a mean savings of 14%. No cost savings were indicated for some small and medium agencies. A separate analysis of potential cost savings, using a statistical model developed from data supplied by agencies which currently contract for fixed-route bus service, predicted that agencies of 100 or more vehicles would save 26 percent of the cost of contracted services.

3102 **(PB—88-869417/XAB) Railroad freight transportation. January 1981-September 1988 (Citations from the NTIS data base). Report for January 1981-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 173p. NTIS PC N01/MF N01.

Supersedes PB—87-861902.

This bibliography contains citations concerning economic aspects, intermodal systems, energy studies, scheduling, accident studies, and regional characterizations pertaining to railroad operations. Freight-car design aspects, engineering analyses, and testing programs are also discussed. (This updated bibliography contains 290 citations, 25 of which are new entries to the previous edition.)

3103 **(SAND—87-0776/1) Inviscid flow field analysis of complex reentry vehicles: Volume 1, description of numerical methods.** Noack, R.W.; Lopez, A.R. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 109p. NTIS, PC A06/MF A01. Order Number DE89002814/JAW.

This is the first of two volumes concerning the SANDia Inviscid Afterbody Code. The SANDIAC computer code predicts the supersonic and hypersonic inviscid flow field about reentry vehicles. The theory, formulation, and results of the code are described in Volume I, and the inputs and usage are described in Volume II. The code solves the three-dimensional, steady-state, Euler equations in finite difference form. The equations are solved in a transformed computational plane. A parabolic grid generation scheme is used to provide body normal grids for complex configurations. The code has options to solve the conservative and nonconservative Euler equations using either upwind differencing or standard centered differencing. The calculations may use either equilibrium or ideal gas chemistry. The code provides the complete flow field in addition to integrated force and moment data as output. 42 refs., 47 figs.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 2894, 3083, 3111, 3270, 3334, 3520

3104 **(DOE/CE/40738—T3) High-intensity drying processes---Impulse drying: Report 3.** Lavery, H.P. (Institute of Paper Chemistry, Appleton, WI (USA)). Feb 1988. Contract FG02-85CE40738. 85p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88016462/JAW.

The past two years of Department of Energy supported research on impulse drying have established the process as one of the most promising alternatives to conventional cylinder drying of paper and paperboard. The early work on impulse drying, documented in the first Progress Report in this series, identified the potential of the process as part of a study of several novel drying and pressing technologies. The second year's work, which is summarized in Progress Report Two included an extensive study on the response of several commercially important grades to impulse drying. The excellent performance of the process in terms of water removal, energy use and properties development was demonstrated during these studies. The present Progress Report covers work completed between October, 1986 and September, 1987. The principal project activity during that period was the design, construction, and preliminary testing of a pilot-scale roll impulse dryer. In addition to this significant equipment development task, experiments were performed to evaluate the effects of impulse drying on very wet sheets and to further develop mechanistic understanding of the process.

3105 **(DOE/ID/12535—2) R and D ceramic tubular distributor plate for advanced FBHX [fluid bed heat exchangers]: Phase 2 contract final report, October 1, 1985--June 30, 1987.** (Aerojet Energy Conversion Co., Rancho Cordova, CA (USA)). Aug 1987. Contract AC07-84ID12535. 219p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88016673/JAW.

Aerojet Energy Conversion Company has developed a Ceramic Tubular Distributor Plate (CTDP) for waste heat recovery fluid bed heat exchangers (FBHX). Fluid bed waste heat recovery system (FBWHRS) performance is greatly improved by avoiding air dilution for inlet gas temperature reduction. A CTDP and special refractory inlet plenum make it practical to introduce undiluted 2500{degree}F flue gas directly into the FBWHRS. The configuration of the CTDP was actually an assembly of 0.406 inch diameter solid rods of 99+% alumina with 0.010 inch nominal spacing to form the orifice--slots. The engineering design, lab scale development, bench scale cold flow development, and cold flow testing preceded successful combustion gas testing with No. 2 Fuel Oil. Extensive testing progressed through two special CTDP buildups with excellent heat transfer and pressure loss data obtained at 1100{degree}, 1600{degree}, 1900{degree}, 2200{degree}, and 2500{degree}F. Structural limitations in the distributor plate configuration were identified and apparently resolved, although final validation of the durability of the design has not yet been completed. Si_3N_4 hot gas lance for cleaning and fouling prevention was readied for combustion development testing. An economic (Simple Payback) analysis based on projected costs of CTDP manufacturing in production quantities was completed. The simple payback for the CTDP system is projected to be a 22% improvement over a FBHX with a conventional metallic distributor plate. The economic analysis was applied on aluminum remelt furnaces.

3106 (DOE/OSTI—11633) Office of industrial programs research in progress. (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Oct 1988. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88016467/JAW.

The US Department of Energy Office of Industrial Programs conducts industrial energy conservation research and development activities. These activities are focused on achieving the objectives of improving energy use efficiency and providing for fuel flexibility within US industry. To accomplish these objectives, the Office has adopted the basic strategy of identifying, in cooperation with private industry, the technological needs for energy conservation in the industrial sector; identifying what private industry is currently doing or will not do alone; selecting the highest priority targets not being pursued by the private sector; and negotiating cost-shared contracts with private industry, or contracts with universities and government laboratories to carry out the necessary research. Research is developed to the point that the new technology has been proven to work and sufficient "proof" can be disseminated to the private sector end users. To date, the Office of Industrial Programs has supported over two hundred research and development projects covering a wide spectrum of industrial applications--both generic conservation technologies and energy intensive processes unique to specific industries. Many of these efforts have resulted in the successful resolution of critical technical barriers faced by industry in developing advanced energy conserving processes and technologies. This report contains summaries for currently active projects supported by the Office of Industrial Programs.

3107 (PB—88-869920/XAB) Recycling rubber wastes. January 1973-September 1988 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-September 1988. (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 125p. NTIS PC N01/MF N01.

Supersedes PB—87-858569.

This bibliography contains citations concerning research and innovations in the area of recycling rubber wastes. Recycling methods and equipment, applications of recycled rubber, and energy-recovery systems and performance are among the topics discussed. Recycling methods compared and contrasted with various rubber waste-disposal techniques are also included. (This updated bibliography contains 297 citations, 54 of which are new entries to the previous edition.)

3108 Consolidation and compaction as a means to prevent settlement of bentonite/sandy silt mixes for use in waste disposal sites. Abeele, W.V. (Los Alamos National Lab., NM (US)). pp 255-264 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

The texture of the local Los Alamos tuff is that of a sandy silt with a high hydraulic conductivity. The permeability is dramatically decreased by addition of small amounts of bentonite. The coefficient of consolidation for bentonite/sandy silt ratios decreases inversely proportional with the square of that ratio, whereas the compression index, the swelling index, and the permeability change index increase with increasing bentonite ratio. A strong relationship also exists between the void ratio and the logarithm of the applied stress for any given bentonite ratio. The empirical linear relationship between the void ratio and the logarithm of the applied stress is excellent and enables the authors to limit the evaluation of conductivity at any void ratio to the measurement of the initial and the desired void ratio, the initial conductivity, and the permeability change index. The decrease in void ratio caused by consolidation or natural compaction of the mixes are scrutinized. Examples of expected settlement and subsidence are calculated based on the known geotechnical characteristics of bentonite/sandy silt mixes. Remedial actions, i.e., means to limit the amount of settlement, are considered. The authors finally discuss their field experiment, which studies the influence of subsidence on layered systems in general and on biobarriers in particular.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 2892, 2894, 3068, 3108, 3548

3109 (DOE/CE/26553—T1) District Heating and Cooling feasibility study, Salt Lake City, Utah: Final report. (Burns and Roe, Inc., Oradell, NJ (USA)). 9 Sep 1988. Contract FG01-86CE26553. 166p. NTIS, PC A08. Order Number DE89002471/JAW.

The following is a general description of the Burns and Roe study of District Heating and Cooling Feasibility for Salt Lake City, Utah. The study assesses District Heating and Cooling (DHC) and develops a conceptual district system for Salt Lake City. In assessing District Heating and Cooling in Salt Lake City, the system conceived is evaluated to determine whether it is technically and economically viable. To determine technical viability, aspects such as implementation, pipe routing, and environmental restrictions are reviewed to foresee any technical problems that would arise as a result of DHC. To determine economic feasibility, the conceived system is priced to determine the capital cost to construct, and modeled in an economic analysis using anticipated operating and fuel costs to produce the required revenue necessary to run the system. Technical and Economic feasibility are predicated on many variables, including heating and cooling load, pipe routing, system implementation, and fuel costs. These variables have been investigated and demonstrate a substantial potential for DHC in Salt Lake City. Areas of consideration include the Downtown Area, Metropolitan Hall of Justice and surrounding area, and the Hotel District.

3110 Combustion and emissions tests of the Vicon Incinerator at Pittsfield, Massachusetts. Neulicht, R.; Visalli, J. New York, NY; American Institute of Chemical Engineers (1987). 32p. (CONF-871113—). American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017.

From American Institute of Chemical Engineers annual meeting; New York, NY, USA (15 Nov 1987).

Technical Paper 113B.

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) can be generated as a result of combustion of municipal solid waste (MSW). However, knowledge is limited about the incinerator design and operating conditions that cause these compounds to form and that can be adjusted to minimize or eliminate their discharge. This paper reports some of the major results of an extensive combustion/emissions testing program designed to gather data related to this topic. The testing was conducted at the VICON Resource Recovery Municipal Solid Waste Facility in Pittsfield, Massachusetts. The study focused on identifying the relationships between incinerator operating conditions, waste characteristics, combustion variables, and levels of PCDDs and PCDFs and selected other semivolatile organic compounds measures in the combustion gases.

3111 The expert system for chemistry: Planning multistep syntheses and conversion of polymeric or hazardous chemical wastes to useful materials. Thiessen, W.E.; Allen, J.D. New York, NY; American Institute of Chemical Engineers (1987). 6p. (CONF-871113—). American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017.

From American Institute of Chemical Engineers annual meeting; New York, NY, USA (15 Nov 1987).

Technical Paper 118B.

Work on the Expert System for Chemistry began when one of the authors had occasion to attempt the use of existing programs for planning chemical transformations and realized the difficulty of making even small changes in a 60,000 line FORTRAN program. The authors describe here the resulting program which is written largely in the production rule based language OPS5.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3112 (CONF-870762—, pp I.1-I.8) **Overview of DOE's transportation conservation heat engine program.** Alpaugh, R.T. 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The goals of the Heat Engine Programs are to improve end-use efficiency and to expand the capability for substitution of alternative fuels for petroleum by developing an applicable industrial technology base. To achieve these goals a balanced program of high risk, high pay-off R & D on promising transportation heat engine propulsion conservation technologies has been constructed. This program aims to provide the automotive industry with proof-of-concepts for advanced engine technology with potential for fuel economy improvement on the order of 30%. Similarly the advanced diesel technology efforts are expected to provide the heavy duty transport industry with like fuel economy improvements. Supporting technologies are included in the program with emphasis on the development of a fundamental advanced materials technology base to provide the ceramics industry with the capability of producing reliable and cost effective components for advanced heat engines. A utilization-oriented fuels data base for heat engine operation on biomass, oil shale and coal derived fuels is also in the development in the program. Sub-programs which are described are: automotive gas turbine, automotive Stirling engine, advanced heavy duty diesel, ceramic technology for advanced heat engines, alternative fuels utilization, and technology transfer.

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 2789, 3065, 3066, 3067, 3134, 3178, 3178, 3179, 3180, 3182, 3182, 3183, 3184, 3185, 3187, 3188, 3189, 3190, 3191, 3194, 3229, 3230, 3517

3113 (CONF-870762—, pp I.9-I.20) **US Army tank-automotive command engine program.** Bryzik, W. (Army Tank-Automotive Command, Warren, MI (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

A number of engine types are continually considered for military vehicle application; however, their current engine thrusts are concentrated within the advanced diesel and gas turbine areas. In addition, other promising government and industrial programs which address advanced engine systems with relevance to military vehicles are closely monitored by the Army. Because of the established thrusts of this conference, emphasis during this briefing is applied to advanced diesel engine technology. Having been pioneered by TACOM, low heat rejection adiabatic type engines form a critical building block for future military propulsion systems over a wide range of power levels and vehicle applications. Examples of past, present, and projected work in the adiabatic diesel area by TACOM is covered. Representative examples of current activities in this area include: (1) a 600 hp engine demonstrator for possible M2 Bradley Fighting Vehicle use, (2) an early adiabatic technology spinoff for application within the M109 Howitzer vehicle, (3) evaluation of low heat rejection technology for military truck application, and (4) developments for application to future classes of main battle tanks. Technology barriers in the areas of (1) high temperature tribology, (2) insulated materials, with emphasis on technology voids in the advanced coating area, and (3) designing with ceramic materials from performance and stress limitation standpoints are particularly critical. Future advances in the adiabatic diesel engine area are directly tied to removing these types of technical barriers. Discussion of goals and current efforts in these areas are covered.

3114 (CONF-870762—, pp I.35-I.49) **Railroad medium-speed diesel engine research.** Furber, C.P. (Association of American Railroads, Washington, DC (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The railroad industry is investigating the use of ceramics as a means of increasing the ability of the medium speed diesel engine to consume a wider range of fuels. On behalf of the railroad industry, the Association of American Railroads (AAR) has included the study of ceramics within its co-operative medium speed diesel engine research program. Tests have been conducted, as part of the AAR program to evaluate the ability of ceramic coatings to: (1) protect engine components against corrosion and erosion; (2) determine the effectiveness of using ceramic coatings as thermal barriers; and (3) increase engine efficiency and reduce maintenance costs. This paper reports on the ceramic coating research undertaken by Southwest Research Institute (SwRI) and by the National Research Council of Canada (NRC) as part of the comprehensive AAR research program. 14 tables.

3115 (CONF-870762—, pp II.1-II.7) **Adiabatic diesel engine development at Ford Motor Company.** Havstad, P.H.; DeBell, G.C. (Ford Motor Co., Dearborn, MI (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

It is appropriate that Ford maintain an active, aggressive interest in new and emerging worldwide diesel engine technology. Currently, major thrusts in technology are directed toward meeting future legislated emission requirements and customer expectations for improved fuel economy, performance and noise control. For research, an emerging technology, the adiabatic or low heat rejection diesel appears to offer significant benefits. These benefits include improved fuel economy, reduced or eliminated cooling system, reduced noise, reduced weight, and increased tolerance for low quality fuels. This paper describes engine concepts, ceramic coatings, ceramic coated components, ceramic inserts and components, and structural ceramics and components.

3116 (CONF-870762—, pp II.9-II.15) **Perspective on low heat rejection diesel engine development.** Hoag, K.L. (Cummins Engine Co., Columbus, IN (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The concept of a low heat rejection or adiabatic engine has recently generated a great deal of interest among diesel engine researchers. Many studies have been reported, addressing the concept in a variety of ways, yet often with conflicting results. A cursory look at the published literature reveals a wide range of conclusions concerning the ultimate potential of the low heat rejection engine concept. The purpose of this paper is to present a recommendation for future research direction, based on the interpretation of engine data and analysis in the published literature. The objective of this paper is threefold; first, to review recent published work on the low heat rejection engine concept. This is not an exhaustive review, but one that identifies some of the most significant, work, either in terms of technical contribution, or because of their impact on the research community - unfortunately these are not necessarily the same criteria. The second objective is to demonstrate that consistent conclusions can be drawn from the seemingly wide range of results which have been reported. Finally, based on the preceding conclusions, directions are identified for further research. 22 references.

3117 (CONF-870762—, pp II.17-II.28) **Analysis of heat transfer in LHR engines. A. Methodology, validation, applications. B. Translucence effects in ceramics.** Morel, T. (Integral Technologies, Inc., Westmount, IL (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Improvement in engine thermal efficiency by reduction of in-cylinder heat transfer is the key objective of the on-going low-heat-rejection (LHR) engine research. This is to be accomplished by retaining within the cylinder the fuel energy normally lost to heat transfer and thus increasing the work done on the piston, as well as providing a higher temperature exhaust steam for energy recovery downstream. This paper reviews the development and ap-

plication of heat transfer methodology suited to low heat rejection engines. It also presents the results of an analytical study of translucence of engineering ceramics. 21 references.

3118 (CONF-870762—, pp II.29-II.32) **Heavy duty transport technology program.** Wood, J.C. (NASA/Lewis Research Center, Cleveland, OH (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The objective of the Department of Energy's Heavy Duty Transport Technology Program is to develop a technology base applicable to advanced low heat rejection diesel engines. The goal is to develop the critical technology required for fuel efficient heavy duty transport engines. The strategy for reaching this goal is to maximize industry involvement, emphasize technology development, rather than product design or demonstration, and concentrate on key technology barriers of a high-risk, long term nature. The program is primarily focused on those engines used in the trucking industry. The approach is to develop the technology required for the engine then demonstrate that technology by running proof-of-concept tests on components in test bed engines. The majority of the development is being conducted through R & D contracts to industry. Emphasis is being placed on high temperature reciprocator components, high temperature emissions and combustion, and effective exhaust heat utilization systems. Future plans call for a continuing effort in the above mentioned areas of technology with emphasis being placed on component development. The paper presents an overview of the program and those aspects of it that involve coating development.

3119 (CONF-870762—, pp II.33-II.49) **Candidate advanced technology for the low heat rejection diesel engine concept.** Fairbanks, J.W. (Dept. of Energy, Washington, DC (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The major emphasis in the DOE/NASA Heavy Duty Transport Technology program is focused on, but not limited to, the low heat rejection (LHR) diesel engine concept, also referred to as the Adiabatic Diesel. The LHR engine concept basically involves thermal insulation of the combustion chamber and exhaust passage to minimize heat loss to the engine block cooling water system, thereby increasing the available energy in the exhaust gas where it is more readily usable. This insulation on the fireside of the combustion chamber components causes many interacting complexities that must be properly managed to achieve a net reduction in fuel consumption. The high temperature surfaces of the insulated combustion chamber components decrease the density of the air during the intake stroke. This lower density air results in an air compression penalty. So success with the LHR engine concept requires exhaust energy utilization which provides a net gain; i.e., a reduction in specific fuel consumption (SFC). This exhaust gas utilization must include turbochargers well matched to the engine. The much higher surface temperatures of the insulated combustion chamber components affects combustion which according to Professor Woschni, University of Munich, results in increased fuel consumption. This challenge by Woschni to the LHR engine concept directly impacts the rate of advanced materials introduction into the diesel engine. Therefore, a short review of Woschni's concerns is presented, along with identification of some problems with Woschni's contentions.

3120 (CONF-870762—, pp III.11-III.17) **Thick thermal barrier coatings for diesel engines.** Yonushonis, T.M.; Roehling, D.P.; Hoag, K.L.; Novak, R.C.; Matarese, A.P.; Huston, R.P. (Cummins Engine Co., Columbus, IN (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

DOE/NASA is sponsoring the development of thick thermal barrier coatings for in-cylinder insulation in heavy duty diesel engines. Major goals of this program are to demonstrate the reliability and performance advantages of thick thermal barrier coatings with a thermal conductance of 410 W/m^2 K (0.5 BTU/hr in^2 F) for a minimum of 100 hours in a Cummins single cylinder V-903 engine. This engine is a four-stroke cycle configuration representative of diesel engines in use in heavy duty (Class 8 trucks). The program has three major tasks: analysis and design; bench test and evaluation; and single cylinder engine tests. This paper presents results to date on the Task 1 and Task 2 efforts which include stresses in the thermal barrier coatings and bench tests.

3121 (CONF-870762—, pp IV.65-IV.72) **Vapor phase tribology for advanced diesel engines.** Klaus, E.E.; Duda, J.L.; Jeng, G.S.; Hakim, N.S.; Groeneweg, M.A.; Balnaves, M.A. (Pennsylvania State Univ., University Park (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Delivery of a lubricant as a vapor mixed with a carrier gas provides a method of controlling the delivery rate of the lubricant. Temperatures in the range of 370 to 800°C are high enough to produce a lubricating film from tricresyl phosphate (TCP) vapor delivered in nitrogen as a carrier gas. The solid film lubricant formed by this delivery system provides excellent lubrication for a four-ball wear tester run at 370°C. Deposit rates are compared for TCP vapor delivered lubrication over a temperature range using stainless steel and quartz surfaces. The deposit rate is sensitive to TCP concentration in the carrier gas. The deposit rates of the TCP decomposition products versus time are reported. Having been demonstrated in laboratory tests, the Vapor Phase (VP) concept is being pursued for hot section lubrication of the advanced (low heat rejection) diesel engines. An advanced cylinder kit, the Separated Ring Belt (SRB) concept isolates the hot combustion area from the side-force region of a conventional piston. The SRB hot zone is treated with VP tribology. Conceptual studies and preliminary analysis examine the potential of the VP concept for engine lubrication. A tribotester has been adapted for testing of VP under simulated engine conditions. The strategy of the advanced diesel engine VP tribology approach, current status, and future plans are reported.

3122 (CONF-870762—, pp IV.73-IV.92) **Development of tribological system and advanced high-temperature in-cylinder components for advanced high-temperature diesel engines.** Kamo, R.; Woods, M.; Sutor, P. (Adiabatics, Inc., Columbus, IN (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The purpose of this program is to develop a new advanced tribological and insulating technology for future military low-heat-rejection (LHR) diesel engines. The objective of Phase I was to select concepts and technologies which would meet the targets and operating conditions of this non-water-cooled military engine. Special consideration was given to the development of a system which would be adaptable to the Advanced Integrated Propulsion System (AIPS) diesel engine with minimal technology transfer. The adiabatic engine has many advantages over conventional diesel engines. The immediate benefits of an installed power plant without a conventional cooling system include improvements in survivability, maintainability, fuel efficiency, packaging, and allowance for greater design flexibility. Improvements in survivability will result from the elimination of failures due to damaged radiators, fans, belts, pumps, and common coolant leaks. Maintenance will be greatly reduced by the elimination of the coolant, belts, and fans. Fuel efficiency gains will result mainly from the reduction of parasitic power losses associated with driving air-handling fans which must force large volumes of cooling air through ballistic grilles, ducts, radiators, and tight crevices. Small improvements of in-cylinder efficiency can be expected by proper insulation and waste-heat utilization. Packaging size requirements will be greatly reduced with the elimination of the radiator, ducting, and fans. Ballistic grille design complexity requirements will be greatly reduced, thereby reducing greater projectile protection level requirements. In addition to the above advantages, an adiabatic engine is expected to have a wider fuel usage tolerance as a result of increased combustion chamber surface temperatures. White smoke dissipation and quicker warm-up can also be attributed to the hot combustion system.

3123 (CONF-870762—, pp IV.95-IV.102) **Friction of piston and ring assembly in a diesel engine.** Morrison, K.; Patterson, D. (Univ. of Michigan, Ann Arbor (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Over the years it has come to be recognized that piston and ring assembly friction is the primary source of friction in the reciprocating diesel engine. Under part-load operation and moderate speeds, piston and ring friction may account for up to 60% of engine friction. In a minimally cooled or adiabatic diesel, piston and ring friction could become excessively high, and in fact could negate much or all of the efficiency benefits of reduced heat rejection. Unlike the friction of some other components of the engine, the measurement of piston and ring friction is very difficult. No satisfactory bench tests have been developed which simulate the complex thermal and mechanical environment of the operating engine. A review of the literature shows that several researchers have reported measurement of piston and ring friction. Pioneering work was done by Forbes and Taylor at MIT in the 1940's. In that study the bore was elastically mounted so that the friction forces between the rings and the liner caused deflections of the bore. These were recorded optically and related to friction. More recently Furuhama et al have developed a moveable bore method for use on both diesel and gasoline engines. Typically moveable bore methods require extensive engine modifications. The present paper discusses two approaches that are being used at the University of Michigan on the Cummins 903 engine. The first is termed the Instantaneous IMEP method and is now well developed. The second is a new method termed the Fixed Sleeve method, and is a derivative of the moveable bore method typified by Taylor and Furuhama.

3124 (CONF-870762—, pp IV.109-IV.118) **Upper cylinder wear simulation in heavy duty diesel engines.** Slone, R.J.; Patterson, D.J.; Morrison, K.; Schwartz, G. (Cummins Engine Co., Columbus, IN (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

In-cylinder components are expected to experience higher operating temperatures and loads in future diesel engine designs, especially for the ring and liners. This will require the development and use of new materials, improved lubricants, and possibly new ring designs to provide an acceptable tribological system. Screening of these new systems in an engine is expensive and time consuming. To expedite screening, the Hohman-A9 high temperature wear simulator has been developed. This is a bench type fixture capable of testing potential lubricant, liner and ring combinations under simulated engine conditions of speed, load, temperature and lubrication. In this paper operating characteristics and test results from the Hohman-A9 tester are described, and a comparison is made with results from the Cameron Plint tester as well as diesel engine tests. Wear test results from the Hohman-A9 are presented for a plasma sprayed chromium oxide ring and liner (identified from engine testing as being a good combination), and a titanium carbide ring and chromium carbide liner (a poor wear combination). The above combinations were tested at 427°C under loaded conditions with and without lubrication. Results are compared with a production chrome electroplated ring and gray iron liner combination.

3125 (CONF-870762—, pp VI.9-VI.17) **Effect of insulated diesel surfaces on performance, emissions, and combustion.** Dickey, D.; Vinyard, S.; Callahan, T.; Keribar, R. (Southwest Research Institute, San Antonio, TX (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The combustion chamber of a single-cylinder, direct-injection diesel engine was insulated with ceramic coatings to determine the effect of low heat rejection (LHR) operation on engine performance, emissions, and combustion. The results showed that the LHR engine performance was not improved compared to the baseline cooled engine. In general, the LHR engine had lower thermal efficiency with higher smoke and particulate emissions. The unburned hydrocarbon emissions were reduced across the load range and the full load carbon monoxide increased. The nitrous oxide emissions increased at some part-load conditions and were reduced slightly at full loads. The poor LHR engine performance was attributed to degraded combustion characterized by less premixed burning and longer combustion duration compared to the baseline cooled engine. The objective of this investigation is not to end the debate on how LHR engine operation affects engine performance, emissions, and combustion, but simply to add the test results for a specific direct-injected diesel engine to the LHR engine database. The experimental results of this investigation were compared with analytical predictions made using Integral Technologies Incorporated's (ITI) IRIS engine model.

3126 **(CONF-880901—4) High temperature friction and wear characteristics of superalloys X-750 and 188 for use in low heat rejection engines.** Erdemir, A.; Fenske, G.R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 27p. NTIS, PC A03/MF A01. Order Number DE89000620/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

Engineering materials for use in low heat rejection engines are required to function under stringent tribological conditions. Severe wear damage and high friction between the components of the tribosystem limit the number of potential materials suitable for such application conditions. The superalloys X-750 and 188 are composed of alloying elements that not only promote a high mechanical and chemical stability but may also result in a reduced wear rate and friction coefficient at elevated temperatures. As a part of the DOE-ECUT Tribology program at Argonne, the present study was undertaken to evaluate the tribological characteristics of these alloys that will also be utilized as the substrates for ion beam deposited lubricous coatings. A wear test rig that crudely simulated the sliding conditions between a piston ring and a cylinder liner in an operating engine was utilized for friction and wear studies. The test results indicated that the wear and friction properties of these alloys were very sensitive to the test temperature. At lower temperatures, the friction coefficients and the wear rates were high. Whereas, at high temperatures (i.e., 600 oC), the coefficients of friction and the wear rates were relatively low and the oxidation of rubbing surfaces was rather severe. 10 refs., 5 figs., 3 tabs.

3127 **(PB—88-241914/XAB) Light-duty automotive technology and fuel-economy trends through 1988. Technical report.** Heavenrich, R.M.; Murrell, J.D. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1988. 72p. (EPA/AA/CTAB—88/07). NTIS, PC A04/MF A01.

This report examines trends in light-duty motor-vehicle fuel economy and technology usage for model years 1978 through 1988. Comparisons with previous year's data are made for the fleet as a whole and for the number of cylinders, vehicle-size class, inertia weight class, and market segment, includes domestic, European, and Asian vehicles.

3302 External Combustion Engines

3128 **(DOE/CE/90002—T1) The Rankine automotive system technology assessment report: Final report.** Thur, G.M. (Chi Associates, Inc., Arlington, VA (USA)). 25 Oct 1988. Contract AC01-87CE90002. 79p. NTIS, PC A05/MF A01. Order Number DE89002693/JAW.

The following major technology advancements developed by the program are described: significant improvements in Rankine component performance, efficiency, size, and weight in the following areas: vapor generator, feed pump, condensers, expanders, and burners; and advancement in the state-of-art for: high heat flux heat exchangers, low emission combustion, controls, once through boiling, and heat engine working fluids. The commercialization results presented in this study reflect a total industry initiative. In fact, the technology was used in fields other than the intended automotive field. The government policy after the termination of the Rankine program was to insure proper documentation of the results. No attempt was made to encourage technology transfer and commercialization of the basic technology. This study shows the societal and

economical impacts that are possible when research technology is converted into products for the marketplace, and also the degree of difficulty associated with technology conversion.

3307 Emission Control

REFER ALSO TO CITATION(S) 3135, 3517, 3521, 3642

3129 **(PB—88-234364/XAB) Investigation into the effect of a ceramic particle trap on the chemical mutagens in diesel exhaust. Research report, July 1983-July 1986.** Bagley, S.T.; Dorie, L.D.; Leddy, D.G.; Johnson, J.H. (Health Effects Inst., Cambridge, MA (USA)). Jan 1987. 74p. (HEI/RR—87/05). NTIS, PC A04/MF A01.

The effectiveness of ceramic porous traps for removing particulate hydrocarbons from diesel emissions was examined, and the effect this has on the mutagenic activity associated with these emissions was determined. A 10.4-liter displacement medium-duty engine (Caterpillar 3208) was run under defined conditions. The levels of total particulate matter, soluble organic fraction, and volatile organic fraction were measured in the emissions both with and without a ceramic trap and at different engine speeds. The results showed an increase in the proportion of nonparticulate hydrocarbons, but the total hydrocarbon levels remained constant. The nonparticulate material had reduced direct-acting mutagenicity, whereas the particulate-associated hydrocarbons (while reduced in proportion) showed increased mutagenicity. Possible explanations for the effect are discussed.

3130 **(PB—88-242920/XAB) Motor-vehicle tampering survey-1987. Final report.** (Environmental Protection Agency, Washington, DC (USA). Div. of Field Operations and Support). Aug 1988. 81p. NTIS, PC A05/MF A01.

See also report for 1986, PB—88-115084.

The Environmental Protection Agency conducted a survey of 7,388 light-duty motor vehicles for tampering with emissions-control devices. All vehicles inspected were classified into one of four mutually exclusive categories: tampered (at least one control device removed or rendered inoperative), arguable tampered (potential, but not clear tampering), malfunctioning, and ok (all control devices present and apparently operating properly). The results were: tampered 19%, arguably tampered 12%, malfunctioning 3% and ok 67%. The survey also found that 7% of the unleaded vehicles were subject to fuel switching (using leaded gasoline in vehicles requiring unleaded fuel).

3131 **(PB—88-244686/XAB) Heavy-duty engine testing report-correlation testing of GMC (General Motors Corporation) 5.7l/MVMA engine. Technical report.** Jones, L. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1988. 54p. (EPA/AA/SDSB—88/06). NTIS, PC A04/MF A01.

The correlation between the heavy-duty test facilities of a manufacturer and the Environmental Protection Agency Motor Vehicle Emission Laboratory (MVEL) is of significant interest to both the manufacturer and EPA. It is especially important from a regulatory standpoint because of Selective Enforcement Audit (SEA) testing requirements. Thus, EPA/MVEL conducted testing on a Chevrolet heavy-duty gasoline-fueled engine with the intent of providing correlation data for comparison with similar data developed by laboratories which conduct SEA emissions tests for the manufacturers of heavy-duty gasoline (HDG) engines. The round-robin program was a joint effort on the part of EPA/MVEL and the Motor Vehicle Manufacturers Association (MVMA).

3132 **(PB—88-246194/XAB) CRC (Coordinating Research Council)-Radian evaporative emissions model: EVAP 2.0 annual report, 1987.** Kishan, S.; DeFries, T.H.; Klausmeier, R. (Radian Corp., Austin, TX (USA)). 24 May 1988. 219p. NTIS, PC A10/MF A01.

The Coordinating Research Council (CRC) contracted Radian Corporation to develop a computer model to characterize real-world evaporative emissions from motor vehicles. This is the first annual report under the contract. It explains the current CRC-Radian evaporative emission model which is names EVAP 2.0. The model expands upon the present EPA MOBILES3 emissions model to incorporate key factors affecting evaporative emission rates, including: representative urban driving patterns to characterize the probability of occurrence of trips during different times of the day; ambient temperatures for different areas and times of year on an hourly basis; fuel tank environments, including fuel weathering, fuel tank heating, and tank cool down; evaporative emissions defined as a function of RVP, ambient temperature, and fuel tank level; emissions of carbureted and fuel-injected vehicles in various states of repair. The model is intended to be used as a research tool and is highly modular, which allows it to be easily updated with new information.

3308 Alternative Fuels

3133 **(PB—88-234497/XAB) Automotive methanol vapors and human health: an evaluation of existing scientific information and issues for future research. Special report.** (Health Effects Inst., Cambridge, MA (USA)). May 1987. 67p. (HEI/SR—87/1002). NTIS, PC A04/MF A01.

This report evaluates the health consequences to humans that may result from inhalation of methanol vapors either emitted from methanol-fueled vehicles or during self-service refueling. EPA analyses predict that the highest exposure levels will occur in personal garages during engine hot-soak, at the self-service pump during refueling, and in public parking garages. Exposure concentrations in traffic situations will be very low. In the worst-case exposure scenario (hot-soak, personal garage), the inhaled body burden of methanol will be approximately equivalent to the preexisting background levels. The increase expected in blood formate after worst-case exposure will be negligible in comparison to the background levels of blood formate. A firm conclusion about the potential health effects from chronic exposures cannot be drawn yet. The characteristics of methanol's chronic effects are not well known. To date, no human epidemiologic studies have reported effects that could be linked to chronic methanol exposures below the threshold limit value of 260 mg/cu m.

3134 **(PB—88-241864/XAB) Near-cylinder dissociation of methanol for automotive application.** (Southwest Research Inst., San Antonio, TX (USA)). Jul 1988. 184p. NTIS, PC A09/MF A01.

This report describes the design analyses and experimental evaluation toward developing a system of dissociating methanol for use in a spark-ignited passenger-car engine. Maximum dissociation of methanol fuel attainable using exhaust-gas heat was the basic goal of the project. The heating value of dissociated methanol is about 20% higher than that for liquid methanol. Therefore, significant energy savings appear to be attainable if a large percent of the engine fuel needs can be dissociated by use of the otherwise wasted heat of the exhaust gas. A heat exchanger consisting of a methanol evaporator, an injection system to provide fuel to the evaporator, and a dissociation catalytic reactor was designed, fabricated, and tested. The dissociation efficiency of the initial reactor was not as good as expected. The relative poor performance of the dissociation reactor apparently was associated with fuel-injector nozzle heating, blockage of passageways in the dissociation reactor, and an ineffective dissociation catalyst. The heat exchanger was redesigned to incorporate improvements, and four heat exchangers were fabricated using the final design.

3135 **(PB—88-241872/XAB) Emissions, fuel economy, and performance of light-duty CNG and dual-fueled vehicles. Technical report.** Bruetsch, R.I. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1988. 43p. (EPA/AA/CTAB—88/05). NTIS, PC A03/MF A01.

This report describes the results of testing four motor vehicles using compressed natural gas as a motor fuel. Included in the report are the description of the test program, the exhaust emission and fuel-economy calculations, and test results.

3136 **(PB—88-242011/XAB) Effects of cranking speed and finely atomized fuel delivery on minimum cold-starting temperature of a methanol-fueled (M100) vehicle. Technical report.** Blair, D.M. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1988. 30p. (EPA/AA/CTAB—88/04). NTIS, PC A03/MF A01.

A serious problem concerning the development of a production model neat methanol-fueled (M100) vehicle is the inability to start such vehicles reliably at cold temperatures. A 1981 Volkswagen Rabbit, modified to operated on M100 fuel, was cold-start tested at the U.S. EPA's Motor Vehicle Emissions Laboratory from March 13, 1987 to April 21, 1988. A starting system, which provided faster cranking speeds, was tested alone and in combination with a manifold-mounted fuel-delivery system capable of generating methanol-fuel droplets at or below 5 microns in diameter. Start attempts were also made using several modified ignition systems, which provided higher energy spark, in combination with faster cranking speed and atomized fuel-delivery systems.

35 ARMS CONTROL

3501 Policy, Negotiations, And Legislation

3137 **(AD-A—196819/7/XAB) Arms control and national security: revealed through two case studies. Master's thesis.** Scott, R.E. (Naval Postgraduate School, Monterey, CA (USA)). Mar 1988. 106p. NTIS, PC A06/MF A01.

The task of this research is to explore the relationship between arms control and national security. The author suggests that national-security issues must dominate arms-control initiatives and that the military command establishment should have an expanded role in shaping current arms-control initiatives. The author considers two case studies to analyze this relationship. The first case study involves cruise missiles and reveals how issues such as politics, budgets, military missions, technology, stability, and verification can impact on arms-control negotiations and national-security. The second case study shows the control that the military can and should exert in areas dealing with both arms control and national security interests. Lastly, the author proposes how the balance of arms control and national security should be achieved in the future.

3502 Proliferation

REFER ALSO TO CITATION(S) 3478, 3479

3138 **(AD-A—196828/8/XAB) Soviet military power: an assessment of the threat.** (Department of Defense, Washington, DC (USA)). 1988. 176p. NTIS MF A01.

Original contains color plates: All DTIC/NTIS reproductions will be in black and white; Availability: Superintendent of Documents, GPO, Washington, DC 20402 PC $10.00 Stock no. 008-000-00488-9. Microfiche furnished to DTIC and NTIS.

Contents include: the nature of the Soviet threat--Soviet national-security policies; Soviet foreign policy under Gorbachev; military resources allocation; Soviet strategic programs and space forces; Soviet conventional forces; an assessment of the threat--the strategic balance; regional and functional balances; research and development: the technological competition; collective security: our risks and responsibilities.

36 MATERIALS

3139 (CONF-870762—, pp I.21-I.33) **Tribology within the Department of Defense.** McConnell, R. 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

A survey of tribology activities currently being conducted in the various laboratories of the Army, Navy, and Air Force are described. This survey was conducted to give an insight to the breadth and scope of tribological studies being conducted to develop advanced materials for future weapon systems as well as to solve current lubrication problems in the field. The information presented is not in great detail, but the organizations conducting the research, along with points of contact, are given if additional information is desired.

3140 (CONF-870762—, pp IV.119-IV.129) **Computerized tribology information system: ACTIS.** Danyluk, S.; Hsu, S.M.; Jahanmir, S. (National Bureau of Standards, Gaithersburg, MD (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The computerization of tribological data by the establishment of a self-sustaining computerized tribology information system is described. This paper outlines (a.) the planning and coordination of an international effort to standardize and disseminate computerized tribological data (b.) the implementation of a self-sustaining ongoing effort that will eventually be supported by industry and (c.) a technical plan for the design of the computer system architecture, development of standardized database formats and, the framework for the database communication and dissemination. This research represents a pioneering effort in the computer architecture of databases since this will be the first time that a technical field as complex as tribology will be computerized. This research also represents the advancement of tribology as a discipline; the computerization will promote the standardization of tribological data and practice and elevate the discipline of tribology.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 2748, 2786, 2822, 2822, 2854, 2937, 2959, 2959, 3001, 3001, 3220, 3222, 3303, 3334, 3340, 3341, 3925, 3925

3141 **(AD-A—196780/1/XAB) Cellular microstructure development in Sm(Co, Fe, Cu, Zr) 8.35 alloys.** Bay, A.E.; Soffa, W.A.; Blachere, J.R.; Zhang, B. (Dayton Univ., OH (USA). Research Inst.). Sep 1987. 6p. NTIS, PC A02/MF A01.

Pub. in IEEE Transaction on Magnetics, Vol. MAG-23, No. 5, 2710-2713(Sep 1987).

TEM studies of Zr-containing 2:17-type permanent magnet alloys show that the cellular microstructure develops from a high-temperature 2:17R phase, first by the precipitation of Sm-depleted, Zr-rich 2:17H platelet phase, then by the precipitation of Cu-rich, Fe- and Zr-depleted 1:15 boundary phase. These results are supportive of, but also suggest refinements to, a model proposed earlier for the metallurgical behavior of these alloys.

3142 **(AD-A—196854/4/XAB) Measurement of residual stress in uranium using energy-dispersive x-ray diffraction. Final technical report, 1 September 1986-30 June 1988.** Sherman, W.F.; Hauesermann, D. (King's Coll., London (UK). Wheatstone Physics Lab.). Jun 1988. 19p. NTIS, PC A03/MF A01.

Energy-dispersive x-ray diffraction using synchrotron radiation was used to perform residual-stress measurements on a bar of uranium. The basic theory of energy-dispersive diffraction is presented, and the features most relevant to the work reported here are discussed. Residual stress measurements were made using the sin squared psi method which is described in detail. Despite using the higher energy radiation produced by the 5 Tesla wiggler of the UK Synchrotron Radiation Source (SRS), the penetration was insufficient to measure inside the bulk of material. Results therefore apply to a thin surface layer which is a mixture of uranium and uranium oxide. Within this surface, we found a residual compressive stress of 1097 MPa. The accuracy of our measurements was limited by the in ability to use transmission geometry as a result of the high absorption. In energy-dispersive diffraction, reflection geometry in high-energy radiation requires low angles of diffraction which limit the range over which the sample can be tilted to perform stress measurements. These points are discussed in some detail in our conclusion where suggestions for future work are made.

3143 **(AERE-R—13182) MOLDY6 - a molecular dynamics program for simulation of pure metals.** Finnis, M.W. (UKAEA Harwell Lab. Theoretical Physics Div.). Jul 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755536/JAW.

The molecular dynamics program MOLDY6 has recently been developed for simulating large numbers of metal atoms. It has been tested on problems of up to 1024000 atoms on a CRAY-2 in order to assess its usefulness and cost for simulating radiation damage cascades. Particular features of the program are: Flexible periodic boundary conditions. Use of the Finnis-Sinclair or Embedded Atom type potentials. A Gear 4-value predictor-corrector algorithm. The Heyes-Smith vectorised link-cell method of neighbour counting. Automatic updating of the size of the timestep. This document describes the most important parts of the code and reports some recent timings of the subroutines.

3144 (CONF-870762—, pp VI.1-VI.8) **Low quality fuel problems with advanced engine materials.** Jones, R.L. (Naval Research Lab., Washington, DC (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

As petroleum resources diminish, the future will bring strong incentives for the use of low quality fuel in engines employing advanced materials. In its present usage, the term advanced materials refers principally to the ceramics silicon carbide (SiC), silicon nitride (Si_3N_4), and stabilized zirconia (ZrO_2); to high-chromium content, silicon-augmented, or specially processed metals; and to ceramic-fiber reinforced metals or ceramics. Other ceramics such as mullite, Ca_2SiO_4, $CaTiO_3$, $ZrSiO_4$, and $ZrTiO_4$ have been suggested for engine usage, but these are as yet little developed. Of the contaminants occurring in low quality fuel, experience to date has indicated that sodium, sulfur, vanadium, phosphorus, and lead are the most likely to cause degradation of the advanced materials projected for future engines. This review is organized therefore to first look briefly at how these contaminants, especially vanadium, react in the molten salt corrosion of metals, and then to examine how the same contaminants react in the molten salt degradation of ceramics. 23 references, 10 figures.

3145 (CONF-870762—, pp VI.45-VI.56) **Protective oxides formed on CoCrAlY coatings.** Aprigliano, L.F. (David Taylor Naval Ship Research Center, Annapolis, MD (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The metallic coatings used to protect the hot-section turbine blades of marine gas turbines are often a mixture of cobalt, chromium, aluminum, and yttrium (CoCrAlY). Using the surface sensitive technique of x-ray photoelectron spectroscopy, the protective oxide scales on CoCrAlY coatings containing nominal levels of 20, 29, and 35 wt% chromium were found to be essentially the same and were predominantly alumina and a yttrium rich phase that is tentatively identified as yttrium aluminum garnet. As increasing levels of chromium in this coating system are known to improve the coating's hot corrosion resistance, the similarity of the initial scales on all these coatings leads to the conclusion that chromium provides its hot corrosion benefit by slowing the propagation phase of the bulk coating attack. 8 references, 7 figures, 6 tables.

3146 **(CTA-IEAV-RP—006/88) Uranium solubility. Part I: basic solubility criteria - initial study.** Moura Neto, C. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Apr 1988. 34p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704173/JAW.

The thermodynamic properties of the metals are important to describe the solubility of one metal in other. In this work the criteria of solubility are discussed and possible uses are emphasized for metallic uranium. The sources of data selected for these calculations and the arrangement of the tables are also discussed.

3147 **(DOE/ER/45310—9) Observation of a reversible grain boundary faceting transition induced by changes of composition.** Ference, T.G.; Balluffi, R.W. (Massachusetts Inst. of Tech., Cambridge (USA)). 21 Sep 1988. Contract FG02-87ER45310. 7p. NTIS, PC A02/MF A01. Order Number DE89002015/JAW.

We report on a novel technique which allows us to observe the faceting transition of a well characterized boundary under controlled thermodynamic conditions in the Cu/Bi system. The results demonstrate clearly that the faceting transition can be driven either forward or backward in a reversible manner by adding or removing small amounts of Bi solute atoms. 15 refs., 5 figs.

3148 **(DOE/RL—88-25) Cost effectiveness study for retrofitting American aluminum production plants with inert anode-cathode systems.** Galambas, J.W.; Eitel, G.L.; Payne, J.R. (Stone and Webster Engineering Corp., Boston, MA (USA)). Nov 1988. Contract AC06-87RL11313. 119p. NTIS, PC A06. Order Number DE89002805/JAW.

The present Hall-Heroult aluminum smelters utilize carbon anodes and cathodes to pass a current through an alumina/cryolite melt to produce elemental aluminum. Since about 1/2 kg of carbon is consumed for every kg of aluminum produced, the carbon anodes must be replaced about every eighteen days in the prebake cells. In addition the undulating surface to the molten aluminum, due to magnetic fields and escaping anode gas, requires that the anode-cathode distance (ACD) be greater than 4.0 cm. This large ACD causes the cell to be less energy efficient because the resistance heating in the electrolyte converts electrical energy to thermal energy without producing aluminum. The combination of a dimensionally stable anode with a drained and wetted cathode would permit reducing the ACD and produce a substantial increase in cell productivity at a lower specific electric energy consumption. The objective of this study is to determine the cost effectiveness of retrofitting American aluminum production plants with inert anode-cathode systems. 1 fig., 5 tabs.

3149 **(EUR—11501) Effect of proton irradiation on tensile properties and microhardness of Cu and a Cu-Cr-Zr alloy.** Appello, M.; Fenici, P. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1988. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755655/JAW.

In order to simulate the effects of 14 MeV neutron damage in materials to be used in the divertor of a Tokamak Fusion Reactor, irradiation was undertaken using 18 MeV protons produced by a cyclotron. The materials investigated were Oxygen Free High Conductivity Cu and a Cu-Cr-Zr alloy from which thin miniaturized specimens were produced for tensile testing and microhardness measurements. Testing of unirradiated material demonstrated that at specimen thicknesses below 0.5 mm the primary effect of decreasing the thickness further was that of lowering the ductility, whilst the yield stress and ultimate tensile strength remained unchanged. Irradiation was carried out at 295/sup 0/C up to a damage level of 0.21 dpa. Post-irradiation testing showed that for annealed OFHC Cu a softening had occurred. For the Cu-Cr-Zr alloy it was found that the strength decreased during irradiation, the fall being approximately 50% at 0.19 dpa.

3150 **(IC—88/200) Diffusion coefficient of hydrogen in niobium and tantalum.** Vargas, P.; Miranda, L.; Lagos, M. (International Centre for Theoretical Physics, Trieste (Italy); Universidad de Santiago de Chile (Chile). Dept. de Fisica; Universidad Catolica de Chile, Santiago). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704734/JAW.

We show that the current data on hydrogen diffusion in Tantalum between 15K and 550K and in Niobium between 135K and 400K can be quantitatively explained by the small polaron theory. The experimental data can be understood assuming ground-state to ground-state tunneling between interstitial sites with tetrahedral symmetry plus an activated contribution due to tunneling between excited states having octahedral symmetry. The break of the

diffusivity curve at T approx. = 250K follows naturally. It evidences the transition between the tetrahedral and octahedral hopping. For Ta the second break of the diffusivity curve at T approx. = 20K indicated the recovering of the ground-state hopping with tetrahedral symmetry. Below T approx. = 10K for Ta and T approx. = 7K for Nb the diffusion coefficient becomes independent of T. (author). 17 refs, 3 figs, 1 tab.

3151 **(IC—88/210) Infrared absorption in pseudobinary InSb/sub 1-x/Bi/sub x/ compounds.** El-Den, M.B.; Mina, N.K.; Samy, A.M.; El-Mously, M.K. (Ain Shams Univ., Cairo (Egypt). Faculty of Science). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704738/JAW.

The group III-V pseudobinary InSb/sub 1-x/Bi/sub x/ compounds, with x = 0, 0.2 and 0.04, were prepared in thin ribbon forms (30 μ) by splat cooling in air. The optical absorption α(λ) was measured in the wavelength range from 4 to 15 μm. The optical energy gap E/sub opt./, was calculated for the three compounds. A shift of the absorption edge towards longer wavelengths with increasing Bi content was observed. (author). 7 refs, 4 figs.

3152 **(IC—88/220) Deformation potentials of some II-VI semiconductors at K=O states.** Galan, J.L.; Camacho, A.; Quiroga, L. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704743/JAW.

We present a tight-binding calculation of the deformation potentials for three II-VI compounds: CdTe, ZnTe and HgTe by very simple strain modifications of nondiagonal tight-binding parameters and compare them with experimental values. The agreement is good for both kinds of deformation potentials: the hydrostatic one which depends on the nondiagonal matrix elements and the uniaxial one which is mainly a measure of the diagonal interactions and thus depend directly on the tight-binding parameters used. (author). 18 refs, 1 fig., 2 tabs.

3153 (INIS-BR—1275, pp 12) **Necessities of crystallography and microstructure techniques in refractory metals.** Pinatti, D.G.; Otero, M.P. (Fundacao de Tecnologia Industrial, Lorena (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3154 **(INIS-BR—1336) Analysis of A-15 phase in the system Nb-Au.** Silveira, M.F. da. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1982. 111p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704795/JAW.

The Nb-Au system contains a A-15 structure with a superconducting critical temperature of the order of 11 K. According to the actually available phase diagrams there is some incertainty, whether the stoichiometric composition Nb/sub 3/Au (75% at. Nb and 25% at. Au) occurs within the limits of stability. In the present work the samples (alloys of Nb and Au) are produced using a technique of melting by condenser discharge. The advantage of this technique consists in the possibility to obtain samples with compositions exceeding the limits of stability, as shown by lattice parameter analyses of the phase A-2 (Nb - solid solution) samples. The A-15 phase is obtained by heat treatments of samples crystallized originally in the A-2 structure. The inductively determined critical temperatures are close to the highest reported in the literature for this compound (11,5 K). Further we show by lattice parameter analyses that we are able to obtain the A-15 phase also with metastable compositions, very probably inclusively with the stoichiometric composition.

3155 **(INIS-BR—1340) Characterization of CdSe polycrystalline films by photoluminescence spectroscopy.** Brasil, M.J.S.P. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1985. 75p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704799/JAW.

The characterization of CdSe polycristalline films were done by photoluminescence spectroscopy, X-ray diffraction analysis, diagrams IxV, and efficiency of solar energy conversion for cells done by these films. The experimental data shown strong temperature dependence of annealing, and the optimum temperature around 650/sup 0/C was determined. The films did not present photoluminescence before heat treatment, but the annealed sample spectrum showed fine structures in the excitonic region, crystal phase transformation, enhancement of grain size, and better efficiency of the cell. Measurements of photoluminescence between 2 and 300 K, showed two bands of infrared emission, width and intense enough. The shape, at half-width, and the integrated intensity of one these bands were described by a configuration coordinate model for deep centers. Based on obtained results, some hypothesis about the origin of these bands and its correlation with efficiency of cells done with CdSe polycrystalline films, are proposed. (M.C.K.).

3156 **(INPE—4253) Fabrication and characterization of semiconductor lasers of Pb/sub 1-x/ Sn/sub x/ Te.** Abramof, E.; Ferreira, S.O.; Bandeira, I.N. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704805/JAW.

The fabrication and characterization of PbTe homostructure diode-lasers are described. The threshold current density is in the range between 2.5 and 10 KA/cm/sup 2/ and the factors that lead to the device degradation are discussed.

3157 **(ITEF—154(1987)) Fracture mode of metals in heavy electric fields.** Zajtsev, S.V.; Suvorov, A.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704818/JAW.

Investigation into the character and micromechanism of fracture of point samples of refractory metals under strong electric field effect is conducted using auto-ion microscopy method. Fracture electric strain-finite point sample diameter (tungsten, molybdenum and some alloys: W-5% Re, W-1.5% ThO/sub 2/) dependence as well as the shape (and microstructure) of fracture surface are studied. Based on analysing the dependence of destructive potential-diameter at the point apex, the form and microstructure of fracture surface, a conclusion is drawn that the micromechanism of the given phenomenon consists in the melting of a thin presurface metal layer, its partial removal by means of electrical field and subsequent amorphization at the expense of fast cooling. The results obtained may be used when developing methods for increasng electrical device resistance to the action of strong electrical field. 17 refs.; 11 figs.

3158 **(JINR-R—14-88-63) Radiation hardening of metals irradiated by heavy ions.** Didyk, A.Yu.; Skuratov, V.A.; Mikhajlova, N.Yu.; Regel', V.R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions; AN SSSR, Moscow. Inst. Kristallografii). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704879/JAW.

Submitted to the journal Zh. Tekh. Fiz. .

The damage dose dependence in the 10/sup -4/-10/sup -2/ dpa region of radiation hardening of Al, V, Ni, Cu irradiated by xenon ions with 124 MeV energy is investigated using the microhardness technique and transmission electron microscope. It is shown that the pure metals radiation hardening is stimulated for defects clusters with the typical size less than 5 nm, as in the case of neutron and the light charge ion irradiation. 9 refs.; 4 figs.; 1 tab.

3159 **(LA-UR—88-3036) Surface mechanical properties of Ti alloys produced by excimer laser mixing of Ti on AISI 304 stainless steel.** Jervis, T.R.; Hirvonen, J.P.; Nastasi, M.; Zocco, T.G.; Martin, J.A.; Pharr, G.M.; Oliver, W.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36;AC05-76OR00033;AC05-84OR21400. 7p. (CONF-881155—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE89000333/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

We have investigated the properties of surface alloys of Ti formed by excimer laser melting and mixing of Ti overlayers on AISI 304 stainless steel substrates. The thickness of the initial Ti surface layers and the fluence and number of pulses used to mix the surface were varied to investigate a broad range of processing conditions. Samples were uniformly translated at different speeds under repetitive pulses of homogenized laser radiation at 308 nm to vary the number of pulses incident on the sample. We investigated the surface structure and composition, the wear and friction behavior, and the surface hardness of the resulting alloys. The extent of mixing is observed by Rutherford backscattering spectroscopy to be proportional to the number of pulses incident on the sample. Amorphous surface layers are formed at some mixing levels with a composition which indicates that Ti substitutes for Fe in the stainless steel on a one to one basis. Incorporation of C from surface and interface contamination is observed but at a level much below that found in comparable ion implanted materials. Friction coefficient measurements indicate that there exists an optimum level of mixing for each layer thickness. Excessive mixing degrades both the coefficient of friction and the wear performance in dry sliding tests. As with the tribological measurements, the surface hardness showed a dependence on amount of mixing. The surface hardness of the as deposited samples was higher than that of the laser mixed samples, initially decreased with mixing, and finally increased with further mixing. 13 refs., 4 figs.

3160 **(N—88-27310) Refractory metal alloys and composites for space power systems.** Stephens, J.R.; Petrasek, D.W.; Titran, R.H. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 31p. (NASA-TM—100946; E—4237; NAS—1.15:100946; CONF-880408—). NTIS, PC A03/MF A01.

From Spring meeting of the Materials Research Society; Reno, NV, USA (4 Apr 1988).

Space power requirements for future NASA and other U.S. missions will range from a few kilowatts to megawatts of electricity. Maximum efficiency is a key goal of any power system in order to minimize weight and size so that the space shuttle may be used a minimum number of times to put the power supply into orbit. Nuclear power has been identified as the primary source to meet these high levels of electrical demand. One way to achieve maximum efficiency is to operate the power supply, energy conversion system, and related components at relatively high temperatures. NASA Lewis Research Center has undertaken a research program on advanced technology of refractory metal alloys and composites that will provide baseline information for space power systems in the 1900's and the 21st century. Basic research on the tensile and creep properties of fibers, matrices, and composites is discussed.

3161 **(NUREG/CP—0064) Proceedings of the 2nd CSNI workshop on ductile fracture test methods.** Loss, F.J. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA); Materials Engineering Associates, Inc., Lanham, MD (USA)). Aug 1988. 339p. (CSNI—105; MEA—2313; CONF-8504336—). NTIS, PC A14/MF A01 - GPO. Order Number TI88017189/JAW.

From 2. CSNI worksho on ductile fracture test methods; Paris, France (17 Apr 1985).

This report is a compilation of papers presented at the Second CSNI Workshop on Ductile Fracture Test Methods, held at OECD Headquarters, Paris, France, on April 17-19, 1985. The contributors addressed advances in test methods to characterize the fracture toughness of structural steels. Sessions were held on new and improved test techniques, standardized J-R curve test procedures, experience and problems with existing techniques, and use of fracture mechanics by the nuclear industry. Summaries of the individual sessions have been prepared by the session chairmen. The meeting identified progress in test methods since the first workshop was held in 1982. A clear movement to standardize J-R curve tests is now apparent. However, there exists a continuing need to improve elastic-plastic fracture test methods.

3162 **(ORNL/Sub—82-22276/01) Kinetics and mechanisms of hydrogen attack in 2.25Cr-1Mo steel.** Chao, B.L.; Odette, G.R.; Lucas, G.E. (Oak Ridge National Lab., TN (USA); California Univ., Santa Barbara (USA). Dept. of Chemical and Nuclear Engineering). Aug 1988. Contract AC05-84OR21400. 294p. NTIS, PC A13/MF A01. Order Number DE89001381/JAW.

It is the purpose of this study to understand the kinetics and mechanisms of the hydrogen attack process in a 2.25Cr-1Mo steel which is a candidate for the pressure vessel material for the coal liquefaction process. An SA387-G22-C2 2.25Cr-1Mo steel together with its heat affected zone and weld sections were used as the material for studying the kinetics and mechanisms of HA. These materials were exposed to 490 to 585{degree}C and 16.2 to 20.7MPa hydrogen pressure for up to 9000 hours. The same materials were exposed to thermal control conditions (490 to 585{degree}C and 0.35MPa helium) so that the difference in volume swelling and mechanical property change is defined as the net effect due to hydrogen alone. Tensile, Charpy impact, and creep/creep rupture properties were evaluated as a function of hydrogen damage. X-ray diffraction and transmission/analytical electron microscopy (TEM/AEM) techniques were used to study the carbide species and their chemical compositions. A two-stage replication/TEM technique was used to study the distribution and growth of methane cavities. Based on the concept of pre-existing cavities and a constrained cavity growth mechanism, a mathematical model is developed and calibrated with experimentally measured parameters. This model is used to predict the material response to temperatures and hydrogen pressures not tested in this study. 125 refs., 74 figs., 36 tabs.

3163 **(PNL-SA—15804) Grain boundary chemistry and intergranular stress corrosion of iron alloys in calcium nitrate.** Jones, R.H.; Arey, B.W.; Baer, D.R.; Friesel, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 31p. (CONF-880901—9). NTIS, PC A03/MF A01. Order Number DE89001730/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

Intergranular corrosion and stress corrosion measurements have been made on Fe alloys in calcium nitrate at 60{degree}C. Tests were conducted on material with grain boundary chemistries ranging from 0.23 monolayers of S with no P to 0.31 monolayers of P with no S. Grain boundary chemistries were measured with Auger electron spectroscopy. Subcritical crack growth rate tests were conducted using compact tension samples with acoustic emission (AE) monitoring done on selected samples. Intergranular corrosion and stress corrosion occurred in all materials tested within the passive regime at 750 mV (SCE). An intergranular corrosion rate of about 10/sup {minus}5/ mm/s and crack velocities of 10/sup {minus}2/ mm/s were observed independent of grain boundary chemistry. A stress corrosion cracking (SCC) threshold of 5 MPa$\sqrt{m}$ was determined, again independent of grain boundary chemistry. Acoustic emission was detected during crack growth, but the results correlate best with fracture of ligaments or inclusions behind the crack tip rather than discontinuous crack jumps. Short atomic length or less than 10 μm jumps would not be detected by the AE monitoring equipment and so, therefore cannot be ruled out. 25 refs., 9 figs., 3 tabs.

3164 **(RFP—4162) A summary of special coatings projects conducted in support of the Die Casting Program.** Selle, J.E. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 12 Sep 1988. Contract AC04-76DP03533. 22p. NTIS, PC A03/MF A01. Order Number DE89002541/JAW.

The usefulness of various kinds of coatings to the die casting program has been studied. This work includes heat transfer and fluid flow calculations, as well as experimental work, to examine the feasibility and characteristics of various types of coatings. Calculations include the effect of surface roughness on fluid flow, con-

ductance as a function of coating thickness, conductivity as a function of coating porosity, and solidification and possible remelting of microspheres of metal. In each case, the model is described and the results are presented. Experimental work involved evaluating the relative insulating value of various coatings and an analysis of commercial flame-sprayed coatings, low-density coatings, and release coatings. In each case, description of the experimental arrangement is given and the results are described. 5 refs., 28 figs., 6 tabs.

3165 **(SAND—88-2084C) Surface deformations resulting from laser spot welding.** Segalman, D.J.; Krieg, R.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-881210—2). NTIS, PC A02. Order Number DE88014964/JAW.

From ASME winter annual meeting; Chicago, IL, USA (1 Dec 1988).

A method is described for modeling a very simple "welding" problem, that of forming and resolidifying a melt pool with a laser on a plate of 99.999% purity aluminum. The details of the optics, chemistry, and heat transfer are not included so that a rather complete description of the solid mechanics model can be presented. A constitutive model is developed which includes a room temperature-to-melt isotropic/kinematic plasticity behavior. The model is exercised on the laser spot problem and the results presented. The very hot and compliant region in and around the melt zone is restrained from radial expansion by relatively cool and stiff surrounding material which extrudes the melt material toward the laser beam. Because of the small laser spot size and the high conductivity of aluminum, cooling is very rapid when the laser is extinguished. The plastic deformations during heating then dictate the residual stress and deformation states in the solidified plate. The final state has a region of high hydrostatic tensile stress directly beneath the solidified melt zone and a slight depression which remains at the weld site. 5 refs., 13 figs., 1 tab.

3166 (UCRL—53868-87, pp 1.1-1.6) **Evaluation of a thermoplastic material model.** Lesuer, D.R.; Goudreau, G.L. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have done a series of experiments to evaluate the rate-independent, isotropic, thermoplastic material model extensively used in the NIKE codes at LLNL. The material model, which predicts deformation behavior involving elastic, plastic, and thermal strains, is derived from J_2 flow theory and follows a two-parameter power law. The experiments, conducted on isotropic, fine-grained, Type 304L stainless steel, were designed to assess the ability of the material model to represent isothermal mechanically monotonic, isothermal mechanically cyclic, and transient temperature stress-strain behavior. The model did an excellent job representing monotonic stress-strain behavior, provided that the material constants were evaluated in the strain range of interest. However, with material constants representative of monotonic loading, the model overpredicted hardening caused by cyclic deformation. For transient temperature experiments the model predicted the correct end point, although the power-law constants had to be evaluated frequently with respect to temperature. The model was unable to account for the Bauschinger effect and for unloading behavior in transient temperature experiments.

3167 (UCRL—53868-87, pp 6.19-6.21) **Electrodeposition of Fe-Ni alloys.** Nobe, K.; Grimmett, D.L.; Schwartz, M.; Dini, J.W. (Univ. of California, Los Angeles (USA)). Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The objective of this work was to learn how to electrodeposit Invar alloys from aqueous solutions. The authors examined the effects of plating solution composition and current density on deposit composition for sulfate, chloride, and a mixture of sulfamate/chloride electrolytes. Best results were obtained with the mixed sulfamate/chloride solution, which exhibited little variation in alloy concentration as a function of current density. Therefore, they used this solution to study the effects of a wetting agent, reducing agents, and stress reducers on deposit composition at various current densities. Thin deposits (< 5 μm) produced in this solution were smooth, with no cracks. However, deposits thicker than 5 μm showed many cracks, indicating high internal stress.

3168 (UCRL—53868-87, pp 6.22-6.24) **Cathodic-arc ion source.** Sanders, D.M. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The ultimate goal of the cathodic-arc source project is to develop a versatile process for efficient application of coatings having characteristics that meet specific LLNL needs. The author is investigating a coating process done in vacuum, one which combines the two techniques of ion beam deposition and self-sputtering. A single cathodic-arc source provides an abundance of ions of the coating material, some of which are deposited directly on the substrate (the object to be coated), and others of which bombard a target of the same material and cause it to sputter off neutral atoms of that material (hence self-sputtering), which are also deposited on the substrate to form part of the coating. The focus has been on improving the cathodic-arc ion source. In FY 87 he demonstrated sources that can produce fine-grained coatings at extremely high deposition rates.

3169 (UCRL—53868-87, pp 7.6-7.17) **Finite-element modeling and experimental measurement of residual stress.** Flower, E.C.; Johnson, G.C.; Freynik, H.S. Jr.; Schackelford, J.F. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The objective is to model and experimentally measure deformation-induced residual stresses in metals. Although the concept of residual stress is not new, the ability to predict and measure it accurately has remained elusive. In FY 87, the authors successfully used finite-element computer codes to model and experimental techniques to measure residual stresses in a stainless-steel ring. Results from a combination of four experimental methods - neutron diffraction, x-ray diffraction, hole-drilling, and acoustoelasticity - are required to describe residual stress completely. In the future, they intend to model and measure residual stress in an anisotropic, noncubic metal and to design an energy-dispersive x-ray diffraction system for the bulk measurement of residual stress.

3170 **A comparison of small angle neutron scattering and x-ray diffraction studies of cobalt precipitates in a Cu-0.95 at. % Co alloy.** Spooner, S.; Iida, S.; Larson, B.C. (Solid State Div., Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). pp 79-84 of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A detailed comparison of small-angle scattering (SANS) and large angle x-ray diffraction methods of characterization of precipitates was undertaken. Cobalt-rich precipitates on the order of 50 A developed after a 17 hour anneal at 570°C were studied in a single crystal sample with SANS and with diffuse x-ray scattering near the (400) Bragg peak. Each scattering data set was analyzed independently in terms of a distribution of precipitate sizes; a detailed comparison is made of the size distribution obtained. A small interparticle interference effect is seen.

3171 **X-ray diffuse scattering from cobalt precipitates in copper.** Larson, B.C.; Iida, S.; Tischler, J.Z.; Lewis, J.D.; Ice, G.E.; Habenschuss, A. (Oak Ridge National Lab., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 73-78 of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Large-angle diffuse scattering has been investigated for the purpose of studying coherent precipitates in a crystal lattice. Detailed calculations have been made of the scattering near Bragg re-

flections from cobalt precipitates in a copper hot lattice. These calculations have been compared to x-ray diffuse scattering measurements made on aged (570°C for 17 hr.). Cu-0.95%Co crystals with x-rays of three different wavelengths at the NSLS. The results indicate that the size distribution, the concentration, and the internal strain of the precipitates can be determined from such diffuse scattering measurements.

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REFER ALSO TO CITATION(S) 2937, 3057, 3114, 3117, 3118, 3120, 3124, 3144, 3145, 3274, 3340, 3353, 3724, 3937

3172 **(AD-A—196373/5/XAB) Far-infrared composite-medium study of sintered La_2NiO_4 and La(1.85)Sr(0.15)CuO(4-y).** Noh, T.W.; Sulewski, P.E.; Sievers, A.J.; McWhirter, J.T. (Cornell Univ., Ithaca, NY (USA)). 1 Oct 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Physical Review B, Vol. 36, No. 10, 5735-5738(1 Oct 1987).

The infrared and far-infrared properties of sintered La_2NiO_4 and La/sub 1.85/Sr/sub 0.15/CuO/sub 4-y/ are modeled accurately within the effective-medium approximation. The electrodynamic properties of La/sub 1.85/Sr/sub 0.15/CuO/sub 4-y/ grains are highly anisotropic with the strong 0.5-eV electronic transition polarized along the low-conductivity crystal direction. The apparent superconducting gap frequency for the sintered material depends crucially on the grain geometry. Our experimental data are fit with needle-like crystallines and grain geometry.

3173 **(AD-A—196374/3/XAB) Comparison of the electrodynamic properties of sintered $YBa_2Cu_3O(7-y)$ and La(1.85)Sr(0.15)CuO(4-y).** Noh, T.W.; Sulewski, P.E.; Sievers, A.J. (Cornell Univ., Ithaca, NY (USA)). 1 Dec 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Physical Review B, Vol. 36, No. 16, 8866-8869(1 Dec 1987).

The reflectivity in the superconducting and normal sites of YBa_2Cu_3O/sub 7-y/ has been reproduced with the effective-medium theory plus an anisotropic dielectric function and the Mattis-Bardeen conductivity with a gap value 2 delta/kBTc=2.5 to 2.7. It was found that the lowest IR-active phonon polarized in the high-conductivity plane produces structure in the superconducting gap, the lowest-frequency phonon perpendicular to the plane is overdamped, and the electronic susceptibility is more isotropic for YBa_2Cu_3O/sub 7-y/ than for La/sub 1.85/Sr/sub 0.15/CuO/sub 4-y/.

3174 **(AD-A—196734/8/XAB) Direct evidence of the importance of electron-phonon coupling in La_2CuO_4: photoinduced ir active vibrational modes. Technical report.** Kim, Y.H.; Heeger, A.J.; Acedo, L.; Stucky, G.; Wudl, F. (California Univ., Santa Barbara (USA). Dept. of Chemistry). May 1988. 15p. (TR—8). NTIS, PC A03/MF A01.

We present direct evidence of the importance of the electron phonon interaction in pure La_2CuO_4. A number of photoinduced IR active vibrational modes(IRAV)and associated bleaching of the La_2CuO_4 phonon modes are observed in the spectral range below 700/cm. The observation of photoinduced IRAV implies the existence of structural deformation around the photoexcited carriers, indicative of coupling of the photoexcitations to the lattice. We find, in addition, evidence of a broad photoinduced absorption at higher energies suggesting an electronic transition deep within the energy gap.

3175 **(AD-A—196787/6/XAB) Free-carrier relaxation dynamics in the normal state of sintered YBa_2Cu_3O/sub 7-y/.** Sulewski, P.E.; Noh, T.W.; McWhirter, J.T.; Sievers, A.J.; Russek, S.E. (Cornell Univ., Ithaca, NY (USA)). 1 Aug 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Physical Review B, Vol. 36, No. 4, 2357-2360(1 Aug 1987).

The conductivity of yttrium barium copper oxide (YBa_2Cu_3O/sub 7-y/)in the normal state was obtained from a measurement of the reflectivity over a wide frequency range. The product of the Drude-model parameters wpt 1 indicates that the plasma oscillations are overdamped. The free-carrier electrodynamics are well described by a frequency-dependent scattering rate which rises linearly in frequency from the dc value and saturates at a value consistent with scattering at the unitarity limit with a concomitant frequency-dependent mass enhancement.

3176 **(AD-A—196955/9/XAB) Analysis of thermodynamic and transport properties of La(2-x)M(x)CuO_4 and YBa_2CuO/sub 7-delta/superconductors.** Langner, A.; Sahu, D.; George, T.F. (State Univ. of New York, Buffalo (USA). Dept. of Chemistry). Jun 1988. 18p. (UBUFFALO/DC—88/TR-72). NTIS, PC A03/MF A01.

Anisotropic Ginzburg-landau theory for coupled s-wave and d-wave order parameters is used to analyze the unique thermodynamic and transport properties of the new La2-x(Ba,Sr)xCuO_4 and YBa_2Cu_3O/sub 7-delta/ superconductors. This simple phenomenological approach is used to explain the prevalence of the large Sommerfeld coefficients of the specific heat, the existence of multiple specific heat anomalies, the ultrasonic attenuation peak, and model the anisotropic critical field data as observed in oriented samples.

3177 **(BNL—41813) Effects of Fe substitutions in $YBa_2Cu_3O_7$.** Yang, C.Y.; Heald, S.M.; Tranquada, J.M.; Xu, Y.; Wang, Y.L.; Moodenbaugh, A.R.; Suenaga, M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016;AS05-80ER10742. 2p. (CONF-8808149—2). NTIS, PC A02/MF A01. Order Number DE89002174/JAW.

From 5. international conference on X-ray absorption fine structure; Seattle, WA, USA (21 Aug 1988).

Both near edge features and EXAFS results unequivocally demonstrate that Fe preferentially substitutes for Cu(1) atoms at the linear chain site for YBa_2(Cu/sub 1-x/Fe/sub x/)$_3O$/sub 7+δ/, where x = 0.02 to 0.15. Electronic and atomic structural changes associated with Fe content are discussed. 5 refs., 2 figs.

3178 (CONF-870762—, pp III.1-III.9) **Seventeen years of thermal barrier coatings.** Goward, G.W. (Turbine Components Inc., Branford, CT). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Seventeen years ago the author worked on what was apparently the first application of a thermal barrier coating in a production gas turbine engine. The coating was applied to a louvered sheet metal transition duct in the hot section of the engine to alleviate a severe buckling, cracking and oxidation problem. The coating was bi-layered, consisting of a metallic bond coat and a top layer of zirconium oxide. The presence of the coating doubled the life of the part. For obvious reasons, this re-kindled interest in a broader range of applications in gas turbines. Subsequent development and applications of more durable coatings led to use on gas turbine burner components, vane platforms, vane airfoils and evaluation on diesel engine pistons, valves and heads. This keynote paper briefly defines thermal barrier coatings and their functions, and then traces the history of their refinement leading to contemporary and potential future applications. Difficulties and successes are described within the limits of proprietary or sensitive information. Suggestions for further work to advance the technology base are made. 22 references.

3179 (CONF-870762—, pp III.19-III.27) **Thick thermal barrier coatings for diesel engine components.** Biehler, D.I. (Caterpillar, Inc., Peoria, IL (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

This presentation reports on work covered under DOE/NASA Thick Thermal Barrier Coatings for diesel components. The objective of this work is to demonstrate the durability potential for a thick coating system with an overall thermal conductance of 0.5 BTU/hr-sq. in.-deg. F (400 W/M² C) and will be demonstrated with a 100 hr. single cylinder engine test. This work involves plasma spraying of zirconia thermal barrier coatings. These coatings will be placed on the pistons, valves and cylinder head of a

single cylinder test engine. The target for this demonstration, of course, is the heavy duty diesel truck engine. 26 figures.

3180 (CONF-870762—, pp III.29-III.42) **Durability and performance testing of ceramic coatings in towboat operation.** Winkler, M.F. (Seaworthy Systems, Inc., Centerbrook, CT (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The results of a 14,000-hour marine industry demonstration of thin ceramic coatings in diesel engine combustion components are truly encouraging. These superior ceramic coatings on the piston crowns, exhaust valves, and the heads have operated in everyday towboat operation for over two years and have demonstrated the durability needed for extended component lifetimes in commercial operation. These ceramic coated components have produced a smoother running engine, with a reduce cetane requirement and a reduced fuel consumption.

3181 (CONF-870762—, pp III.43) **Electron-beam physical vapor deposition development of zirconia coatings.** Shankar, R. (Chromalloy Gas Turbine Corp., Orangeburg, NY (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Thermal barrier coatings (TBC) based on zirconia are being used to insulate critical hot-section components of gas turbine engines either to reduce cooling air requirements or to increase the gas temperature, thereby increasing the thermodynamic efficiency of the engine. Development of TBC's by electron beam physical vapor deposition results in a columnar ceramic structure caused by the line-of-sight deposition process. This allows the coating to withstand very high thermal shocks due to the alleviation of the residual stresses resulting between the bond coating and the TBC from the differential thermal expansion coefficients. Factors involved in the deposition by PVD and their effects on adhesion and durability of the TBC's, bond coating composition's key role in the adhesion process and optimum compositions, and Mach 0.3 barrier rig testing and engine testing of TBC components are important, as well as further directions in the PVD ceramic coating program both in terms of compositions and process parameters.

3182 (CONF-870762—, pp III.45-III.48) **Lessons learned from NASA's thermal barrier coatings work.** Miller, R.A. (NASA/Lewis Research Center, Cleveland, OH (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

For the last two decades NASA has been investigating the science of plasma sprayed thermal barrier coatings, first in gas turbine engines for aircraft applications and currently in diesel engines. The paper discusses what has been learned from the research at NASA on the behavior and failure mechanisms of coatings, life modeling development, crystal phases in zirconia-yttria coatings, and optimization of coatings exposed to hot salt condensates. The need for automation and quality control during both research and production is discussed.

3183 (CONF-870762—, pp III.49-III.62) **Advanced ceramic coatings for marine gas turbine engines.** Wortman, D.J.; Nagaraj, B.A. (General Electric Co., Cincinnati, OH (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

With the objective of making more fuels available worldwide for its fleet, the US Navy is sponsoring programs to study the effects of lower quality fuels on engine performance and life and to develop ceramic coatings for protection of marine gas turbine components against vanadium-assisted hot corrosion. The most common ceramic material for thermal barrier coatings, yttria stabilized zirconia (YSZ), while capable of providing significantly greater corrosion resistance than the best metallic coatings is attacked by vanadium assisted hot corrosion. Ceria is an alternative stabilizer that may offer improved hot corrosion resistance. Ceramic coating microstructure has also been shown to be very important to hot corrosion resistance. Porosity in the ceramic may allow salts to penetrate to the metallic bond coat where rapid corrosion may occur. Another failure mechanism which has been observed is spallation on thermal cycling due to the freezing of the salt in the pores of the ceramic. On the other hand, denser ceramic coatings increase the probability of cracking or spallation due to thermal expansion mismatch between the ceramic and the metal substrate. The objectives of testing the YSZ coating were to evaluate its spallation resistance in a marine environment and to determine if salts would penetrate the porosity in the ceramic and lead to hot corrosion of the bond coat. Blade pairs with this coating as well as BC21 and several developmental coatings were tested back-to-back in LM2500 engine 806/10 on the GTS Callaghan for 1077 hours behind a single-stage moisture separator which results in an average sea salt ingestion level of 0.006 ppm in this installation. Results for YSZ, and ceria-stabilized zirconia coatings are given. 25 figures.

3184 (CONF-870762—, pp III.63-III.71) **Development and performance of physical vapor deposition thermal barrier coating systems.** Strangman, T.E. (Garrett Turbine Engine Co., Phoenix, AZ (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Thermal barrier coatings (TBCs) for turbine airfoils in high-performance engines represent an advanced materials technology that has both performance and durability benefits. Foremost of the TBC benefits is the reduction of heat transferred into air-cooled components. Other potential benefits include increased resistance to hot corrosion and oxidation. In order to achieve these benefits, however, the ceramic coating system must be reliable. TBCs applied by physical vapor deposition (PVD) processes are currently tailored to achieve superior strain-tolerant microstructures which facilitate reliable operation in aircraft propulsion engines. In particular, the electron beam evaporation/physical vapor deposition (EB/PVD) process can produce ceramic coatings with a highly strain-tolerant columnar microstructure, which is well bonded to the oxidation resistant metallic layer of the system. Intercolumnar gaps between the ceramic grains reduce the effective modulus in the plane of the coating and permit ceramic-metal thermal expansion mismatch and thermal strains to be accommodated without producing large stresses. Microstructures of EB/PVD coatings are being further modified to densify the outer surface of the ceramic coating to achieve improvements in hot corrosion and erosion resistance for industrial-marine and aircraft gas turbine engine applications. The impact of projected modifications of the PVD process aimed at achieving tailored ceramic coating microstructures is discussed from the perspective of ceramic coating lives achieved in burner rig tests. Predicted ceramic coating lives for specified engine-mission environments are also discussed.

3185 (CONF-870762—, pp III.73-III.81) **Coatings for diesel engines and associated problems.** Kvernes, I.; Noerholm, O. (I.K. Engineering, Oslo (Norway)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The major reasons coatings are used in internal combustion engines are to enhance corrosion and wear resistance of the engine parts, to reduce the heat load on components, and finally to improve the combustion process. The major advantages of the Adiabatic Diesel Engine Concept are summarized. This presentation is focused on three topics: basic research on zirconia coating systems and activities to improve various properties; testing and analysis of 2 mm thick zirconia coatings in a medium speed diesel engine; and zirconia coatings on aluminum base alloy engine components.

3186 (CONF-870762—, pp III.83-III.89) **Design criteria for a coating to reduce contact stress damage.** Sarin, V.K. (GTE Labs., Inc., Waltham, MA (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Present day high strength, oxidation resistant materials for advanced heat engine applications are susceptible to contact stress damage at ceramic/ceramic interfaces. It has been suggested that substantial reductions in surface damage and strength loss under sliding contact can be attained by the application of a thin ceramic coating. However, the stringent conditions imposed by heat engine environments mandates that these coatings be adherent, capable of withstanding thermal cycling, and oxidation resistant at extremely high temperatures. Finite element analysis and equilibrium thermodynamic calculations were used to aid in the design of a coating configuration that can achieve these objectives. The conceptual design and development of the proposed coating is discussed.

3187 (CONF-870762—, pp IV.11-IV.17) **Wear-resistant ceramic coatings for diesel engine components.** Weiss, C.D. (Caterpillar, Inc., Peoria, IL (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The goal of this technical program is to develop wear-resistant coatings for application to metallic components of low heat-low diesel engines, specifically, piston rings and cylinder liners. The effects of the combustion environment upon coating characteristics such as microstructure, wear, strength, adherence, and other properties shall be minimal. Obtaining adequate coating adherence will be the first problem to be addressed in developing wear resistant coatings. An experimental plan will be developed for each coating system to optimize the adherence of the chosen coatings. After optimization for adherence, the coatings will be screened for wear and friction. Further adjustments to the coating systems will be made to optimize for wear and friction. Statistical experimental design will be used in developing the experimental plan. While performance will not be sacrificed, simplicity of design and ease of coating application will be important considerations throughout the program. Details are given of the plans for this research program.

3188 (CONF-870762—, pp IV.19-IV.24) **Development of advanced diesel wear coatings.** Naylor, M.G.S. (Cummins Engine Co., Columbus, IN (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Future engine manufacturers trends for heavy duty diesel (HDD) engines are driving toward: (a) higher top ring reversal temperatures (through the use of in-cylinder insulation and high top ring positions), (b) decreased oil supply to the compression rings (to meet emissions requirements), and (c) extended durability goals (e.g., 1 million miles mean time before overhaul). These requirements will place much greater stress on the in-cylinder tribology system, which in a conventional HDD engine is typically comprised of Cr electroplated rings, grey cast iron cylinder liners and a mineral oil based lubricant. In order to meet future durability goals, it will be necessary to develop more advanced tribology systems, which provide greater wear resistance than conventional materials under marginally lubricated conditions, and at higher operating temperatures. This paper reviews the wear test techniques developed at Cummins Engine Company for simulating the piston ring: cylinder liner environment. Preliminary results for conventional and advanced (coating) materials are presented.

3189 (CONF-870762—, pp IV.49-IV.51) **Silicon nitride ceramic wear resistant machine elements.** Bentz, J.C. (Cummins Engine Co., Inc., Columbus, IN (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Cummins Engine Company, Inc. and a ceramic material supplier-partner have been developing potential near term applications of silicon nitride (Si_3N_4) ceramics for wear resistance in diesel engines. The primary activities have included a component selection process, development of low cost designs, materials, and manufacturing processes, and the evaluation of these components in bench and engine tests. As a result of these activities, several components have been evaluated which show dramatically improved resistance to wear and the potential for low cost manufacturing.

3190 (CONF-870762—, pp IV.103-IV.108) **Dynamic contact of ceramics.** Dufrane, K.F. (Battelle Columbus Div., OH (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Significant efficiency improvements have been predicted resulting from the practical application of low-heat-rejection engines. With associated predictions of top-ring-reversal temperatures exceeding 300°C and possibly reacting 650°C, these engines require solutions to wear problems for such sliding components as rings, cylinders, pistons, and valve mechanisms. Liquid lubricants, the traditional proven approach for controlling wear of metals used in conventional internal combustion engines, are not available for continuous service at the predicted temperatures to be encountered in low-heat-rejection engines. Therefore, ceramics as a class of materials are of interest to address the wear problems. High hardnesses, corrosion resistance, strength at elevated temperatures, and high elastic moduli are attractive properties not generally available in metals, which could be expected to compensate at least partially for the lack of availability of liquid lubricants. All-ceramic and part-ceramic engines have been assembled and evaluated on a limited basis. Basic studies of the friction and wear of ceramics in sliding contact have also been made, mostly using pin-on-disk apparatuses. However, few studies have been made to study the wear mechanisms of ceramics using a controlled laboratory apparatus to reproduce the important sliding parameters of actual engines without the problems associated with operating fired engines. The study described in this paper addresses the wear mechanisms of ceramics applied to the reciprocating sliding contact of the ring/cylinder interface in low-heat-rejection engines. The approach has been to use simple ceramic specimens in a laboratory apparatus that reproduces the important parameters of actual engines. Models of the wear process are being developed based on experimental data.

3191 (CONF-870762—, pp V.1-V.7) **Plasma spray processing and equipment requirements for thermal barrier coatings in advanced heat engines.** Hecht, R.J. (United Technologies Corp., Palm Beach, FL (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Plasma spray deposition of both metallic and ceramic thermal barrier coatings is widely used for oxidation protection and increased component temperature capability in aircraft gas turbines. Ceramic coatings are of particular interest because of the substantial improvements in engine efficiency which are achieved through increases in turbine inlet temperature. Corresponding advantages result from use of thermal barrier coatings in diesel engines. The performance and durability of a ceramic coating are determined by the inherent properties of the coating material and the nature of the microstructure which results from processing of the coating. Although progress has been made in the former area (i.e. understanding of composition effects, optimization of microstructure, and development of new coating chemistries), the more significant advances of the past decade have probably involved process automation. A fully automated plasma spray cell coating production system, for example, is currently being operated by the US Air Force at the San Antonio Air Logistic Center, and process qualification for selected engine components has been achieved. The successful implementation of this system contributes to the data and experience base for transfer of thermal barrier coating technology to diesel engine applications.

3192 (CONF-870762—, pp V.9-V.14) **Cathodic arc deposition, materials, and systems.** Nibbe, W.G. (Vac-Tec Systems, Inc., St. Paul, MN (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The cathodic arc plasma deposition process has been used to evaporate materials including titanium, aluminum, copper, tantalum, chrome, niobium, and others. The pure and reacted films have been analyzed for morphology, adhesion, friction, and hardness, plus undergone tests relating to specific applications. Tests to determine resistance to corrosion and the stability of thicker films have been

done with selected materials. Generally, the test results have been better with the cathodic arc deposited films as compared with similar materials applied with evaporation or sputtering. The hard coatings generated with cathodic arc and a reactive gas (nitrogen) have normally provided test results superior to an uncoated substrate. Coating uniformity tests were conducted with various cathode sizes. These tests were done to establish the capability of this process to coat uniform critical dimensions plus develop economics of large scale production vacuum coaters and substrate fixturing. The characteristics of the cathodic arc deposition process enable it to provide uniformity similar to or better than comparative processes and at competitive production costs while avoiding environmentally hazardous materials.

3193 (CONF-870762—, pp V.29-V.34) **Ion-beam assisted coating deposition.** Smidt, F.A. (Naval Research Lab., Washington, DC (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Today a wide variety of thin film deposition and coating processes such as biased sputtering, activated reactive evaporation, ion plating, cathodic arc deposition, plasma assisted chemical vapor deposition and ion-beam assisted deposition all make use of energetic ions to enhance the properties of the deposited films. In spite of the widespread interest in this approach, the understanding of the physical processes producing these beneficial effects is rather poorly understood. The US Naval Research Laboratory has undertaken a program to identify and characterize the major processes occurring during ion-beam assisted deposition (IAD) so they may be used more effectively in all deposition processes. The IAD process consists of a vapor flux produced by evaporation or sputtering, a flux of energetic ions produced by an ion gun and in some cases a reactive atmosphere. Ion-beam assisted deposition was selected for study because of the ability to independently control the major process variables - vapor flux, ion flux, and their relative rates; ion energy, substrate temperature and the pressure (and purity) of the atmosphere. 20 references.

3194 (CONF-870762—, pp V.35-V.44) **Improved wear surfaces by ion implantation.** Lankford, J. (Southwest Research Institute, San Antonio, TX (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

An experimental program has been conducted to investigate the friction and wear behavior of ceramic materials being considered for use in high-temperature adiabatic engines. Pin on disk type tests were conducted in a simulated diesel environment at 800°C using ceramic-ceramic couples made up of SiC, TiC, and TiC-Ni-Mo pins tested against Si_3N_4 and partially stabilized zirconia disk surfaces modified by ion beam mixing with Co, Cr, Ni, or Ti-Ni. The coefficients of friction for each couple were determined from these tests, and the amount of wear determined by profilometry of the wear surfaces. Scanning electron microscopy, Auger electron spectroscopy, and energy dispersive spectroscopy were used to characterize the wear surfaces. The results of these tests show that most non-ion/mixed ceramic-ceramic couples have relatively high wear rates, and coefficients of friction above about 0.25. Ion beam mixing of disk material surfaces with Ti-Ni produced coefficients of friction as low as 0.06, values close to that for liquid lubricated metal couples run at much lower temperature. Surface modification with Co or Ni produced some promising results, while Cr did not improve the wear characteristics of the disk materials. Auger analysis suggests that the formation of lubricious oxide layers is responsible for the superior friction and wear behavior of the Ti-Ni ion-implanted disks. 30 references.

3195 (CONF-870762—, pp V.45-V.60) **Influence of raw materials on the performance characteristics of ceramic coatings.** Rigney, D.V.; Mantkowski, T.E.; Froning, M.J. (General Electric Co., Cincinnati, OH (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

This paper presents some of the results of a study examining the interrelationships of ZrO_2-Y_2O_3 powder in the ceramic coating plasma spray process and the performance of the deposit. Examples of powders manufactured by several different processes, such as (1) spray drying, (2) spray drying and sintering, (3) sintering and crushing, (4) casting and crushing, and (5) casting, crushing, and fusing, were initially characterized for particle size and shape, microstructure and morphology, surface area, density, flow characteristics, and qualitative phase distribution. The powder manufacturing process did have significant effects on all the above characteristics. The powders were air plasma sprayed using identical spray parameters and fixturing on a Hastelloy-X substrate which had been Vacuum Plasma Sprayed (VPS) NiCrAlY bond coated. The coated samples were characterized for microstructure, erosion resistance, and quantitative phase distribution. The coatings predominantly contained the tetragonal phase, even when the starting powder material was monoclinic. The more porous coatings appeared to withstand a greater number of thermal cycles. In these sequences, coarser powders tended to produce longer-lived coatings than powders with a relatively low mean powder size. Also, coatings exhibiting modest (> 5%) fractions of monoclinic phase appeared to withstand less number of thermal cycles than those containing only tetragonal or cubic phases. In addition, the thermal cycling exposure tended to induce a transformation of all the available phases to tetragonal form. Improvements in the thermal cycle performance of certain spray dried examples were achieved after resizing, but the improvement achieved did not approach the levels observed in sintered or cast or fused powder structures. 14 references, 16 figures, 5 tables.

3196 (CONF-870762—, pp VI.19-VI.43) **Environmental effects on engine ceramics.** Hecht, N.L.; Graves, G.A.; McCullum, D.E. (Univ. of Dayton, OH (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The University of Dayton Research Institute has concluded a study on the effects of environment on the mechanical behavior of commercially available transformation toughened zirconia ceramics. A three-phase program was conducted to investigate strength, slow crack growth, and low temperature (150-300°C) aging in environments of controlled amounts of water vapor and in dry nitrogen. This presentation describes some of the property data obtained and discusses some of the major results of the study. 12 references, 28 figures, 8 tables.

3197 (CONF-8806103—3) **Characterization of fiber-matirx interfaces in ceramic composites.** Lowden, R.A.; Stinton, D.P.; Besmann, T.M. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01. Order Number DE89001195/JAW.

From International conference on whisker- and fiber-toughened ceramics; Oak Ridge, TN, USA (7 Jun 1988).

The mechanical behavior of Nicalon/SiC and Nextel/SiC composites has been improved by applying thin coatings to the fibers prior to densification to control the interfacial bond. Varying degrees of bonding have been achieved with different coating materials and layer thicknesses. Fiber-matrix bond strengths have been quantitatively evaluated using an indentation technique. The expressions for calculating frictional stress from indent impressions were modified to account for the irregular shape of the Nextel fibers. The influence of interfacial frictional stress on fracture phenomena such as matrix cracking and postfracture behavior has been examined. 31 refs., 8 figs., 1 tab.

3198 (FRNC-TH—3380) **Phenomenology of uranium-plutonium homogenization in nuclear fuels.** Marin, J.M. (Aix-Marseille-1 Univ., 13 - Marseille (France)). 7 Mar 1988. 151p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755656/JAW.

The uranium and plutonium cations distribution in mixed oxide fuels (U/sub 1-y/ Pu/sub y/)O/sub 2/ with $y \leqq 0.1$ has been studied in laboratory with industrial fabrication methods. Our experiences has showed a slow cations migration. In the substoichiometry (UPu)O/sub 2-x/ the diffusion is in connection with the plutonium valence which is an indicator of the oxidoreduction state of the crystal lattice. The plutonium valence is in connection with the oxygen ion deficit in order to compensate the electrical charge.

The oxygen ratio of the solid depends of the oxygen partial pressure prevailing at the time of product elaboration but it can be modified by impurities. These impurities permit to increase or decrease the fuel characteristics and performances. An homogeneity analysis methodology is proposed, its objective is to classify the mixed oxide fuels according to the uranium and plutonium ions distribution.

3199 **(IC—88/243) Comparison of Y-Ba-Cu-O compositions prepared from BaCuO/sub 2/ and Ba/sub 2/Cu/sub 3/O/sub 5/.** Porjesz, T.; Halasz, I.; Rockenbauer, A.; Kirschner, I.; Kovacs, G.; Karman, T.; Zsolt, G. (International Centre for Theoretical Physics, Trieste (Italy); Central Research Inst. for Chemistry, Budapest (Hungary); Roland Eoetvoes Univ., Budapest (Hungary). Dept. for Low Temperature Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704750/JAW.

A two step synthesis route has been elaborated for the preparation of YBaxCu/sub 1.5/xO/sub z/ superconductor series. It has been shown that the Ba/sub 2/Cu/sub 3/O/sub 5/ double metal oxide, prepared in the first step, is essential in formation of YBa/sub 2/Cu/sub 3/O/sub 9-d/ and sharply differs from any other proposed barium cuprate. A wide composition range from x=2 to 17 was prepared from this compound by addition of Y/sub 2/O/sub 3/ without disappearance of superconductivity. Resistivity measurements hint at existence of two superconducting phases. ESR investigations revealed on a baseline hysteresis, depending on the actual value of x. (author). 53 refs, 7 figs.

3200 **(IC—88/244) Preparation dependent superconductivity in T1CaBa/sub 2/Cu/sub 3O7./5/sub +-d/ above 100 K.** Porjesz, T.; Halasz, I.; Traeger, T.; Kovacs, G.; Kirschner, I.; Zsolt, G.; Karman, T. (International Centre for Theoretical Physics, Trieste (Italy); Central Research Inst. for Chemistry, Budapest (Hungary); Central Research and Design Inst. for Silicate Industry, Budapest (Hungary); Roland Eoetvoes Univ., Budapest (Hungary). Dept. for Low Temperature Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704751/JAW.

Different heat treatment procedures were applied during the sample preparation process, which result in different superconducting properties in the samples of the same nominal composition of TlCaBa/sub 2/Cu/sub 3/O/sub 7.5+-d/. It manifests itself in the different critical temperatures having values of 104 K, 107 K and 93 K. The effect of heat treatments is reflected in the structural and magnetic properties as well. (author). 6 refs, 5 figs.

3201 **(IC—88/251) High-T/sub c/ superconductivity of Tl-Ba-Ca-Cu-O samples.** Porjesz, T.; Kirschner, I.; Kovacs, G. and others. (International Centre for Theoretical Physics, Trieste (Italy); Roland Eoetvoes Univ., Budapest (Hungary). Dept. for Low Temperature Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704755/JAW.

A TlBaCaCuO/sub 4.5+x/ compound has been investigated from the point of view of superconductivity. Depending on the heat treatment, one part of the sample exhibits superconductivity with an onset of 121 K and zero resistivity of 106 K and the other part of them shows a sharp drop in resistivity at 130 K which hints at an existence of superconducting grains. This picture was confirmed by magnetic and ESR measurements giving possibility for estimation of critical magnetic fields. (author). 5 refs, 6 figs.

3202 **(IC—88/276) Vortex structure in high-T/sub c/ ceramic superconductors.** Saif, A.G.; Chela-Flores, J. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704766/JAW.

We consider penetration of magnetic flux in the rare earth ceramic superconductors within the framework of a generalized Ginzburg-Landau theory, based on the coexistence of antiferromagnetism and superconductivity. We study vortex structure produced for a magnetic field close to H/sub c(sub 1)/. We make a new prediction that may serve to test the theory experimentally. (author). 22 refs.

3203 (INIS-BR—1275, pp 15) **In-Situ kinetics of oxygen uptake and removal in high T/sub c/ superconductors by XAS in the dispersive mode.** Tolentino, H.; Dartyge, E.; Fontaine, A.; Tourillon, G.; Gourieux, T.; Krill, G.; Maurer, M.; Ravet, M.F. (9150268FR; Centre National de la Recherche Scientifique, 54 - Nancy (France). Lab. de Physique de Solide). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3204 (INIS-BR—1275, pp 11) **Electric conductivity of SnO/sub 2/ doped with Nb/sub 2/O/sub 5/, CuO and Bi/sub 2/O/sub 3/.** Las, W.C.; Santilli, C.V.; Gouvea, D.; Matheus, M.A.; Varela, J.A. (UNESP, Araraquara (Brazil). Inst. de Quimica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3205 **(INIS-BR—1301) Influence of impurity content and particle size in the sinterability and microstructure of alumina.** Castanho, S.R.H.M.; Paschoal, J.O.A. (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 21p. (In Portuguese). (CONF-8804217—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704540/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

In ceramic processing the milling step is known to be responsible for most of the contribution for the increase in impurity content. Friction and collision, wich occur during milling, lead to wear of the milling media increasing the amount of impurities in the ceramic material. In this work the sintering behavior and the final microstructure are studied as a function of the contamination and the particle size distribution after milling. Sintering tests have been carried out in the 1500/sup 0/C - 1700/sup 0/C temperature range for 1 to 5 hours. The sinterability of alumina has been studied under different milling conditions according to the following experimental route: density measurement, linear retraction dependence on time and temperature by dilatometric analysis and microstructural analysis by scanning electronic microscopy and X-ray diffraction

3206 **(INIS-BR—1306) Study of the cubic - to - monoclinic transformation in magnesia partially stabilized zirconia.** Muccillo, R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 14p. (In Portuguese). (CONF-8804217—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704545/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

The transformation of the cubic phase to the stable monoclinic phase in ZrO/sub 2/: 3%MgO quenched from 1450/sup 0/C to RT has been studied by X-ray diffractometry in order to explain the thermal hysteresis in the electrical conductivity. The monoclinic-to-cubic ratio has been measured for samples annealed in the 500/sup 0/C-1000/sup 0/C temperature range. The results show that the decrease in the cubic phase content is the main responsible for the thermal hysteresis in the electrical conductivity of the magnesia partially stabilized zirconia solid electrolytes.

3207 **(INIS-BR—1307) Preparation and characterization of the ZrO/sub 2/: MgO ceramic compound.** Muccillo, E.N.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 12p. (In Portuguese). (CONF-8804217—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704546/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

Zirconium oxide (ZrO/sub 2/); magnesium oxide (MgO) and zirconia-magnesia (ZrO/sub 2/: MgO) ceramic specimens have been prepared by the precipitation and coprecipitation chemical methods. Some of the process parameters, pH and temperature, have been studied. The qualitative as well as the quantitative results are in good agreement with the results reported in scientific journals. The details of the experimental procedures and the phase analysis of the calcined samples will be described.

3208 **(INIS-BR—1308) Utilization of niobium pentoxide as additive for reducing the 'in situ' reaction temperature of ceramic composites in the system mullite-zirconia.** Melo, F.C.L. de; Cairo, C.A.A.; Piorino Neto, F.; Cunha, P.A.; Devezas, T.C. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil)). (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 14p. (In Portuguese). (CONF-8804217—).

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

Ceramics Composites of the system mullite-zirconia were produced through reaction sintering, following the equation: 27rSiO/sub 4/ + 3A1/sub 2/O/sub 3/ + x(A1/sub 2/O/sub 3/ + Nb/sub 2/O/sub 5/) -> 2ZrO/sub 2/ + A1/sub 6/Si/sub 2/O/sub 13/ + 2xA1NbO/sub 4/, with different x values (0.05, 0.1 e 0.25), trying to investigate the role of niobia as sintering aid. Through X-ray difraction was evaluated the fraction of zirconia tetragonal phase retained in the ceramic matrix, and the produced composites were characterizated as to the apparent porosity and density, sintering shrinkage and rupture strength. The reaction sintering temperature was reduced from 1600 oC (X=0) to 1400 oC (with x=0.1).

3209 **(INIS-BR—1309) Electrical resistivity measurements in superconducting ceramics.** Muccillo, R.; Bressiani, A.H.A.; Muccillo, E.N.S.; Bressiani, J.C. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 9p. (In Portuguese). (CONF-8804217—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704548/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

Electrical resistivity measurements have been done in (Y, Ba, Cu, O) - and (Y, A1, Ba, Cu, O) - based superconducting ceramics. The sintered specimens were prepared by applying gold electrodes and winding on the non-metalized part with a copper strip to be immersed in liquid nitrogen for cooling. The resistivity measurements have been done by the four-probe method. A copper-constantan or chromel-alumel thermocouple inserted between the specimen and the copper cold finger has been used for the determination of the critical temperature T/sub c/. Details of the experimental set-up and resistivity versus temperature plots in the LNT-RT range for the superconducting ceramics are the major contributions of this communication.

3210 **(INIS-BR—1310) Study of the distribution of magnesium in zirconia-magnesia ceramic solid electrolytes.** Muccillo, R.; Nogueira, R.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 7p. (In Portuguese). (CONF-8804217—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704549/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

ZrO/sub 2/: 3%MgO ceramic samples have been prepared according to three different experimental procedures in order to find out the best method for processing powders for the conformation of solid electrolytes for disposable oxygen sensors. These procedures were I) simple mechanical mixing, II) homogeneization in liquid medium, and III) homogeneization of the ceramic pellet by grinding, pressing and sintering. All samples have been analysed by electron microprobe and electrical resistivity measurements. The main results show the same degree of homogeneity and electrical resistivity are obtained for the specimens of the 2nd and 3rd group, whereas the specimens of the 1st group have non-homogeneous distribution of magnesium and scattered values of electrical resistivity.

3211 **(INIS-BR—1311) Ionic conductivity measurements of ZrO/sub 2/: MgO prepared by sintering the coprecipitated powders.** Muccillo, E.N.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 14p. (In Portuguese). (CONF-8804217—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704550/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

Ionic conductivity measurements have been carried out in ZrO/sub 2/: MgO ceramic specimens obtained by calcination in the 600/sup 0/C - 1000/sup 0/C temperature range followed by sintering in the 1200/sup 0/C - 1500/sup 0/C range. The powders were of three origins: I) by coprecipitation of the hydroxides, II) by precipitation of the hydrous zirconium oxide, calcination and mixing with magnesium oxide, and III) by the thermal decomposition of the zirconium oxichloride followed by mixing with magnesium oxide. All the specimens have been characterized by X-ray diffractometry analysis and by electrical resistivity Arrhenius plots in the 400/sup 0/C - 700/sup 0/C temperature range.

3212 **(INIS-BR—1338) Study of vibrational and rapid local motions of hydrogen in the storage compound Ti/sub 0.8/ Zr/sub 0.2/ CrMnH/sub 3/ by slow neutron scattering.** Mestnik Filho, J. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1987. 188p. (In Portuguese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704797/JAW.

The vibrational and the rapid local motions of hydrogen in the storage compound Ti/sub 0,8/ Zr/sub 0,2/ CrMnH/sub 3/ have been studied by slow neutron scattering with the beryllium-filter-time-of-flight spectrometer. The form of the density of states of the normal modes of vibrations in host metal does no appear to change on hydrogenation, but a shift of 25% towards lower frequencies has been observed. Debye temperatures for the metal and corresponding hydride have been estimated to be respectively (522 +- 15)K and (311 +- 10)K. An energy distribution consisting of three peeks ~ 50mev (FWHM) wide corresponding to the energy transfer of 85, 115 and 141mev has been observed and were attributed to hydrogen local vibrations in three types of interstices wich differs in composition of Ti and Zr atoms. In the quasielastic scattering, a broadening of 15μev has been detected for the momentum transfer Q = 2,1(angstrom)/sup -1/ and for temperature T= 125/sup 0/C. The broadening has been attributed to rapid local motions of hydrogen in a dumb-bell of lenght equal to the jump lenght for diffusion, 1 approx. 3(angstrom).

3213 **(ND-R—1519(S)) Preparation and characterisation of lithium metasilicate and γ-lithium aluminate pellets.** Kennedy, P.; Rigby, F.; Gilchrist, K.E. (UKAEA Northern Research Labs., Springfields). Jul 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755484/JAW.

Lithium metasilicate and γ-lithium aluminate are being examined as potential solid breeder materials for the Next European Torus (NET). At Springfields Laboratory the powders have been prepared by reacting lithium carbonate with the appropriate oxides in the temperature range 600-900/sup 0/C and compacts made by hot pressing in the same temperature range, a route which enables density and grain size to be accurately controlled. Kinetic measurements have been made on the lithium carbonate/silica and the lithium carbonate/alumina reactions and the powder characteristics have been shown to depend on the characteristics of the initial silica and alumina powders. Hot-pressing characteristics have also been examined and optimised. Physical and mechanical property measurements have been made on both materials and the results are presented and discussed.

3214 **(ORNL/Sub—85-22028/1) Processing and characterization of transformation-toughened ceramics with strength retention to elevated temperatures: Final report.** Cutler, R.A.; Hansen, J.J.; Prouse, D.W.; Bright, J.D.; Virkar, A.V.; Shetty, D.K. (Oak Ridge National Lab., TN (USA); Ceramatec, Inc., Salt Lake City, UT (USA)). Jul 1988. Contract AC05-84OR21400. 69p. NTIS, PC A05/MF A01. Order Number DE89001312/JAW.

Al_2O_3-ZrO_2 three layered composites were fabricated in such a way that the outer layers of the bar-shaped specimens consisted of Al_2O_3 and unstabilized ZrO_2, and the inner layer consisted of Al_2O_3 and partially-stabilized ZrO_2. Upon cooling from the sintering temperature, part of the ZrO_2 in the outer layers transformed from tetragonal (t) to monoclinic (m), while the inside layer ZrO_2 remained tetragonal. The transformation created compressive stresses in the outer layers and tensile stresses in the bulk. The depth of the outer layers (and therefore the magnitude of the residual stresses) was controlled during green forming. Residual stresses at room temperature varied depending on the outer layer thickness. The increased strengths of the three layer specimens were obtained in the as-fired unground condition, demonstrating that the stresses introduced are the result of transformation-induced stresses during cooling, and did not from transformation produced by grinding. Specimens with residual surface compressive stresses were 200 MPa stronger at 750{degree}C than monolithic specimens, demonstrating the viability of this approach for improving elevated temperature mechanical properties. Strain gauge, x-ray diffraction, and indentation/strength measurements were used to verify the existence of the macroscopic residual stresses. Slip casting and tape casting were investigated as alternative green forming routes to powder pressing. The substitution of HfO_2 for ZrO_2 in order to increase the transformation temperature was investigated. 28 refs., 25 figs., 7 tabs.

3215 **(SAND—88-1380C) Applications of the potential microprobe to electronic ceramic materials.** Schubert, W.K. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-8810195—1). NTIS, PC A03/MF A01. Order Number DE89002035/JAW.

From 41. Pacific coast regional meet of American Ceramic Society; San Francisco, CA, USA (24 Oct 1988).

The potential microprobe consists of a fine tipped tungsten needle mounted on a computer controlled, three axis mechanical/piezo positioner. The probe is mounted to the stage of a standard scanning electron microscope, and allows one to make electrical potential measurements on a very fine spatial scale (≧ 10 nm). The potential microprobe and its operation are discussed. Applications of the technique to polycrystalline silicon, ceramic superconductors, and ZnO varistor materials are presented. 19 refs., 4 figs.

3216 **(SAND—88-2976C) Synthesis and properties of low carbon boron carbides.** Adkins, C.L.J.; Campbell, A.N.; Headley, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-8810195—2). NTIS, PC A03/MF A01. Order Number DE89002184/JAW.

From 41. Pacific coast regional meet of American Ceramic Society; San Francisco, CA, USA (24 Oct 1988).

Boron carbides of low carbon content (<10%) were produced from BCl_3 and CCl_4 at 1273--1673 K in a CVD reactor. TEM revealed that tetragonal boron ccarbide and β-boron formed under the most carbon depleted gas-phase conditions. Interactions have been observed between the graphite substrates and the deposits at elevated temperatures. The microstructure of the deposits will be discussed. 6 refs., 5 figs., 1 tab.

3217 **(SAND—88-2990C) Joining and bonding mechanisms in nitrogen ceramics.** Loehman, R.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-880529—6). NTIS, PC A03/MF A01. Order Number DE89001820/JAW.

From MRS international meeting on advanced materials; Tokyo, Japan (30 May 1988).

Nitrogen ceramics, such as Si_3N_4 and AlN, can be bonded using liquid phase compositions that wet the ceramic and react with it. Reaction may be by dissolution and diffusion, as with molten oxides on Si_3N_4, or by an oxidation-reduction mechanism, as is found with Al and Ti-containing alloys on Si_3N_4 and AlN. Reaction products predicted by simple thermodynamic calculations have been observed when reaction interfaces are analyzed. Potential joining compositions that do not react with Si_3N_4 or Al neither wet nor adhere to them. 31 refs., 9 figs., 1 tab.

3218 **(SLAC-PUB—4698) In situ growth of superconducting YBaCuO using reactive electron-beam coevaporation.** Missert, N.; Hammond, R.; Mooij, J.E.; Matijasevic, V.; Rosenthal, P.; Geballe, T.H.; Kapitulnik, A.; Beasley, M.R.; Laderman, S.S.; Lu, C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 5p. (CONF-880812—20). NTIS, PC A02/MF A01. Order Number DE89002071/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

Conditions required for in situ growth of YBaCuO thin films by reactive electron-beam evaporation have been explored. Three sources of activated oxygen (atomic oxygen from microwave discharge, a plasma generated by electron beams, and an ion beam) were compared. The best results so far were obtained with atomic oxygen. Epitaxial films with high critical currents were grown on $SrTiO_3$ <100> and <110>, Al_2O_3 <1{bar 1}02> and MgO <100> at 600{degree}C. Evaporation rates were controlled with a rate monitor using atomic absorption. 16 refs., 2 figs., 1 tab.

3219 **The agglomeration of point defects in transition metal monoxides.** Gartstein, E.; Radler, M.; Mason, T.O.; Cohen, J.B. (GALAI, Industrial Zone, 10500 Migdal Haemek (IL)). pp 65-72 of Characterization of defects in materials. Siegel, R.W.; Weertman, J.R.; Sinclair, R. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Recent results on the diffuse scattering from single crystals of Fe/sub 1-x/O at high temperatures reveal that the defect structure is in striking agreement with embedded cluster calculations. The dominant defect is an imperfect 7:2 cluster. Mixtures of this and a larger complex (13:4) can explain the electrical properties. XANES studies of this oxide are in agreement with other theoretical work. However, in both Fe/sub x/O and Mn/sub x/O it is not possible to use the shift of the cation K absorption edge to characterize valence. In fact in the latter case the shift passes through a minimum, perhaps indicating the onset of clustering.

3606 Other Materials

REFER ALSO TO CITATION(S) 2917, 2919, 2919, 3028, 3082, 3095, 3096, 3118, 3121, 3160, 3299, 3314, 3326, 3468

3220 **(AD-A—195523/6/XAB) Low temperature pulsed plasma deposition. Part 1. A new technique for thin-film deposition with complete gas dissociation. Technical report.** Scarsbrook, G.A.; Llewellyn, I.P.; Ojha, S.M.; Heinecke, R.A. (STC Technology Ltd., Harlow (UK). Systems Components Div.). 12 Apr 1988. 25p. (IR—503/1988/1444-PT-1; STL—01-PT-1). NTIS, PC A03/MF A01.

Conventional continuous plasma processes, for both deposition and etching, have three limitations. These limitations are: 1) incomplete gas dissociation, 2) gas depletion effects, and 3) substrate heating, either by the plasma itself or as a requirement of good film quality during deposition. However, all three of these disadvantages can be overcome in a novel process, where high-power r-f energy is pulsed. In this paper the pulsed plasma process and equipment is described in detail, and applications of its unique capabilities are discussed.

3221 **(AD-A—196354/5/XAB) Synthetic metals from intercalated graphite. Final report, 10 October 1984-30 September 1987.** Dresselhaus, M.S.; Dresselhaus, G. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Materials Science and Engineering). 9 May 1988. 32p. NTIS, PC A03/MF A01.

A summary is presented of research carried out over the three-year period October 1, 1984 - September 30, 1987 on the program Synthetic Metals from Intercalated Graphite. The research covers Synthesis and Compositional Characterization of Graphite Intercalation Compounds, Structural Studies, Lattice-Mode Studies, Electronic Structure, Transport Properties, Magnetic Studies in Graphite-Intercalation Compounds, Superconductivity Studies in Graphite Intercalation Compounds, and Review Articles and Plenary Invited Talks.

3222 **(AD-A—196673/8/XAB) Optimization of the thermoelectric figure of merit of modified silicon-germanium alloys. Interim report No. 2.** Rowe, D.M. (University of Wales Inst. of Science and Technology, Cardiff (UK). Dept. of Physics, Electronics, and Electrical Engineering). May 1988. 9p. NTIS, PC A02/MF A01.

In this report a working theoretical model for the power factor (alpha squared sigma) of silicon germanium alloys is presented and the dependence of this parameter on carrier concentration and number of valleys explored. Although silicon-germanium alloys cannot be described as narrow-band-gap semiconductors, the high level of doping employed in thermoelectric applications necessitates the inclusion in the theoretical model of deviations from the usually assumed parabolic bands. The dependence of the Seebeck coefficient (alpha), electrical conductivity (sigma), and the power factor (alpha squared sigma) on carrier concentration and number of valleys N/sub v/ are presented. Two main conclusions can be drawn from the reported results. A large number of equi-energetic valleys give rise to a higher power factor at room temperature, when intervalley scattering can be considered negligibly small. Higher doping levels are required in order to take advantage of the large number of valleys.

3223 **(AD-A—196876/7/XAB) Ion-assisted deposition of optical thin films. Doctoral thesis.** Targove, J.D. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 215p. (AFIT/CI/NR—88-57). NTIS, PC A10/MF A01.

The columnar microstructure of most thermally evaporated thin films detrimentally affects many of their properties through a reduction in packing density. In this work, the author investigated ion-assisted deposition as a means of disrupting this columnar growth for a number of coating materials. A Kaufman hot-cathode ion source bombarded thermally evaporated films with low-energy (<1000 eV) positive ions during deposition in a cryopumped box coater. The author investigated MgF_2, Na_3AlF_6, AlF_3, LaF_3,CeF_3,NdF_3,Al_2O_3, and AlN. Argon ion bombardment of the fluoride coatings increased their packing densities dramatically. He achieved packing densities near unity without significant absorption for MgF_2,LaF_3, and NdF_3, while Na_3AlF_6,AlF_3, and CeF_3 began to absorb before unity packing density could be achieved. Fluorine was preferentially sputtered by the ion bombardment, creating anion vacancies. The films adsorbed water vapor and hydroxyl radicals from the residual chamber atmosphere. These filled the vacancy sites, eliminating absorption in the visible, but the oxygen complexes caused increased absorption in the ultraviolet. For LaF_3 and NdF_3, a sufficient amount of oxygen caused a phase transformation from the fluoride phase to an oxyfluoride phase.

3224 **(AD-A—197040/9/XAB) Novel composite materials: alloys from immiscible components. Final report, 1 April 1987-31 March 1988.** Michl, J. (Texas Univ., Austin (USA). Dept. of Chemistry). 17 Jun 1988. 7p. NTIS, PC A02/MF A01.

The ultrahigh-vacuum deposition chamber permits deposition of solid matrices under clean conditions onto a plate held at 20 K. As hoped for, the use of a clean environment and of very low deposition temperatures permitted the investigator to accomplish the primary objective of the research: single molecule isolation of dopants in an alkali halide matrix. Previously, it was only possible to obtain alkali halide matrices containing aggregated dopants. This breakthrough opens new vistas in matrix-isolation spectroscopy, photochemistry, and chemistry.

3225 **(AD-A—197041/7/XAB) Synthesis and properties of cdte films. Final report, 1 March 1984-30 September 1987.** Schetzina, J.F. (North Carolina State Univ., Raleigh (USA)). 20 Jun 1988. 22p. NTIS, PC A03/MF A01.

This program of research was established to develop CdTe epitaxial films and quantum-well structures by molecular beam epitaxy (MBE) and to study their physical properties. During 1983-1985, CdTe films were successfully deposited on various substrates including sapphire, silicon, and gallium arsenide. The films were judged to be of high quality on the basis of photoluminescence and x ray diffraction rocking curve studies. Using the photoassisted MBE technique to prepare n-type CdTe and CdMnTe layers led to the fabrication of field-effect transistors based on these materials. The present program has impacted profoundly on the development of the II-VI semiconductors studied and has contributed significantly to a strong resurgence of interest in these materials. The work impacts on the areas of optoelectronics, magnetooptics, integrated optics and infrared detector technology.

3226 **(BNL—41199) A new ionic conducting polymer based on oligo(ethylene oxide) substituted Nylon-1.** Liu, H.; Lee, H.S.; Okamoto, Y.; Liu, L.F.; Skotheim, T. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 16p. (CONF-8710283—6). NTIS, PC A03/MF A01. Order Number DE89001098/JAW.

From Symposium on electroresponsive polymers; Upton, NY, USA (4 Oct 1987).

Complexes of the polymer CF_3SO_3Li were prepared and the ionic conductivities as a function of ethylene oxide unit length were measured. In this paper, we report the preliminary results with these systems. 14 refs., 5 figs.

3227 **(BNL—41738) Ordered Langmuir-Blodgett films of polypyrrole and analogs.** Rahman, A.K.M.; Samuelson, L.; Minehan, D.; Clough, S.; Tripathy, S.; Inagaki, T.; Yang, X.Q.; Skotheim, T.A.; Okamoto, Y. (Brookhaven National Lab., Upton, NY (USA); Lowell Univ., MA (USA); Polytechnic Univ., Brooklyn, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-880669—20). NTIS, PC A02/MF A01. Order Number DE89001091/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

Ordered mono and multilayers of polypyrrole and its analogs were prepared using a Langmuir-Blodgett film balance. Films could be transferred with facility and were picked up on microscope grids for electron microscopic studies among a number of other investigations. Scanning electron microscopy (SEM) revealed a smooth coverage over a large surface area of the substrate. Electron diffraction from these thin films revealed that the nature of packing is substantially different from bulk grown polypyrrole. 8 refs., 7 figs.

3228 **(BNL—41739) Polypyrrole-$LiCF_3SO_3$ composites formed by in situ pulsed potentiostatic electropolymerization.** Harris, C.S.; Odegard, R.; Skotheim, T.A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880669—18). NTIS, PC A02/MF A01. Order Number DE89001093/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

Composites of polypyrrole and poly(ethylene oxide)*$LiCF_3SO_3$ were formed by in situ electropolymerization of polypyrrole at 0.8, 1.0 and 3.0 V vs. a platinum pseudo-reference electrode. The peak separation in solid state cyclic voltammograms under conditions placticized by acetonitrile for the in situ formed polypyrrole indicate that the resistance to ion transport within the composites is lower for composites formed by pulsed potentiostatic electropolymerization at 3.0 V, compared to composites grown by stepping the potential to 0.8, 1.0 or 3.0 V. 9 refs., 4 figs.

3229 (CONF-870762—, pp IV.1-IV.10) **High temperature tribology - the challenge of the adiabatic diesel engine.** Klaus, E.E. (Pennsylvania State Univ., University Park (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

It appears that a continuous supply of lubricant will be required to supplement ceramics, hard coats, solid-film lubricants, and combinations of these to satisfy the requirements of low heat rejection engines. Reactions in boundary lubrication take place at great-

er than 300°C to produce friction polymer which in turn provides an easily sheared film. Exploration of this chemical reaction approach appears to have some promise in the development of high temperature lubrication. Thermal stability limits of the C-C bond (371°C) and the aromatic ring (450°C) places limits on the conventional liquid delivered recirculating lubrication system. In almost all cases, oxidative stability is less than the thermal stability of these lubricants. These facts only suggest that long life recirculating liquid lubrication systems have a low probability of success. The high temperature reactions (both thermal and oxidative) over the range of 300 to 1200°C indicate that an easily sheared lubricant film may be provided by many of the conventional lubricants. In order for the rapid chemical reactions that occur in the 300 to 1200°C temperature range to provide lubrication without forming excessive deposits or destroying the bearing surface, both the rate of delivery and the resultant chemical reactions must be controlled and understood. Lubrication based on these considerations could be applied with the fuel, the air or directly to the piston ring-cylinder zone. Lubrication by these methods would require bearing designs compatible with boundary lubrication. 24 references.

3230 (CONF-870762—, pp IV.53-IV.63) **High temperature liquid lubrication development challenge.** Jung, A.K.; Slone, R.J. (Stauffer Chemical Co., Dobbs Ferry, NY (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

Attempts to improve the performance and efficiency of diesel engines focuses on low heat rejection concepts. These concepts require engine optimization at temperatures significantly higher than those of conventionally cooled engines, particularly in the piston ring-cylinder liner contact area at top ring reversal. These temperatures exceed by a wide margin the operating capabilities of currently available lubricants. The lack of availability of high temperature liquid lubricants presents a major obstacle in the path of development of advanced high temperature diesel engines. The following, self explanatory view-graphs, summarize the results of the development of a diesel crankcase engine lubricant, capable of performing in a temperature range above that of conventional petroleum oils.

3231 (CONF-870762—, pp V.15-V.27) **Diamond thin films by plasma enhanced chemical vapor deposition - the emerging technology for hard coatings.** Ravi, K.V. (Crystallume, Palo Alto, CA (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The recent development of low pressure vapor deposition techniques for diamond films have dramatically changed the prospects for the practical utilization of diamond of various forms in various applications. The ability to synthesize diamond from methane and other hydrocarbons and deposit the diamond on a variety of substrates opens up a vast arena of uses. The unique properties of diamond will extend the capabilities of products and processes as well as open up the possibility of an entirely new class of applications. PECVD (Plasma Enhanced Chemical Vapor Deposited) diamond films of thicknesses ranging from a few hundred nanometers to tens of micrometers have been reported. This paper reviews the status of the technology of plasma enhanced chemical vapor deposition (PECVD) of diamond films. A description of the basic process is followed by an analysis of the characteristics of these films with regard to their structural and physical properties.

3232 **(CONF-8806103—5) Properties of SiC whisker-reinforced oxide matrix composites.** Tiegs, T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89002204/JAW.

From International conference on whisker- and fiber-toughened ceramics; Oak Ridge, TN, USA (7 Jun 1988).

Development of SiC whisker-reinforced alumina and mullite composites is discussed. Improved mechanical properties are observed for the composites as compared for the monolithic materials. Near-net-shape fabrication by pressureless sintering is limited by the SiC whisker content and the practical limit to achieve high densities is about 20 vol%. Limited bonding at the matrix-whisker interface is necessary for high toughness composites. The surface chemistry of the whiskers has been found to be an important parameter in determining that bond strength. 15 refs., 3 figs.

3233 **(DOE/ER/45114—4) Statistical mechanics of polymer systems: Final report.** Kovac, J. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 15 Feb 1988. Contract FG05-84ER45114. 13p. NTIS, PC A03/MF A01. Order Number DE89002012/JAW.

We have made major progress in the development of computer simulation methods for the study of lattice models of polymer chains and have applied those methods to several problems of current interest. Much of our effort has gone into development and testing of the models in order to be sure that the results are physically meaningful and not artifacts of the lattice model. In addition, we have expanded the scope of dynamic Monte Carlo lattice models by including a nearest neighbor interaction energy. This allows us to study solvent and temperature effects on the chain dynamics. The three major problems that we have studied include the motion of chains in dense systems and the validity of the reptation model, the dynamics of chains in the theta region, and the dynamics of collasping polymer chains. 12 refs.

3234 (INIS-BR—1275, pp 24) **Application of x-ray diffraction methods to quality catalysts of supported nickel.** Rodrigues, M.M.M.M.; Salim, V.M.M.; Frety, R. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica; Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1988 (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3235 **(ITEF—192(1987)) Neutron diffraction study of CCl/sub 4/ plastic phase under pressure.** Smirnov, L.S.; Zuj, V.N.; Buzin, V.I.; Alikhanov, R.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704820/JAW.

Neutron diffraction study was made on the crystal structure of CCl/sub 4/ 1 Bridgman phase at high pressure (1.5-3.5 kbar). Press-Huller model describing orientational disordered molecule behaviour was used for interpretation of neutron diffraction patterns. The fact of libration motion in the plastic 1/sup a/ CCl/sub 4/ phase was established. Satisfactory agreement for observed and calculated neutron diffraction patterns was obtained. 21 refs.; 2 figs.

3236 **(JINR-R—14-88-64) Influence of irradiation by / sup 12/C and /sup 22/Ne ions on electrical properties of zinc oxide crystals.** Didyk, A.Yu.; Kuznetsov, V.I.; Skuratov, V.A.; Shestakov, V.D.; Kuz'mina, I.P.; Pisarevskij, Yu.V.; Regel', V.R.; Sizova, N.L.; Sil'vestrova, I.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions; AN SSSR, Moscow. Inst. Kristallografii). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1988. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704880/JAW.

C/sup 12/ /90 MeV/ and Ne/sup 22/ /160 MeV/ ion irradiation influence on dielectrical, piezoelectrical and mechanical properties is studied. It is shown that the irradiation leads to considerable changes of electromechanical properties, which could be explained by radiation stimulated processes of impurity atom redistribution. 12 refs.; 2 figs.; 3 tabs.

3237 **(LA-UR—88-3043) Resonance Raman excitation profiles of polyacetylene/polyisoprene block co-polymers in toluene.** Agnew, S.F.; Aldissi, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-880669—24). NTIS, PC A03/MF A01. Order Number DE89000330/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

We have measured the resonance Raman spectra and excitation profiles of a soluble polyacetylene/polyisoprene block-copolymer in toluene solution. These are the first reported excitation profiles that have been referenced to an internal solvent standard, the toluene Raman bands. We find that this copolymer exhibits the same two bands in the C=C stretch region, i.e., 1463 and 1519 cm/sup {minus}1/, that have been attributed to a bimodal distribution in conjugation length for polyacetylene thin films. The 1519 cm/sup {minus}1/ peak has been associated with short chain segments of polyacetylene and we assign it to an average chain length of N=11 C=C's based on the frequency of the peak of its excitation profile. The excitation profile of the 1463 cm/sup {minus}1/ mode peaks at 2.15 eV corresponding to a chain length of 31 C=C's. Based on the relative integrated intensities of these two excitation profiles, our block copolymer contains a 35% mole fraction of long chain segments to short chain segments. In contrast to previous results, we find that the 1294 cm/sup {minus}1/ band, which is a mode with a mixture of C-C stretch and C-H deformation, is resonance enhanced, with an excitation profile that peaks at 2.6 eV, the same energy as the 1519 cm/sup {minus}1/ mode's profile. 2 figs.

3238 **(LBL—26035) Breakdown voltage mapping of impurity concentrations in GaAs wafers.** Bliss, D.E. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 62p. NTIS, PC A04/MF A01. Order Number DE89002489/JAW.

Using a modified x-y plotter, spatially resolved breakdown voltage measurements were obtained for a variety of GaAs materials. Breakdown voltage values were calibrated against net impurity concentration using C-V measurements. Spatially resolved Hall effect measurements on GaAs doped with Si correlated well with a breakdown voltage map of the impurity concentration. The technique provides a quick means for determining doping uniformity in epitaxial films and implanted layers as well as dopant incorporation rates in bulk crystals. An inverse correlation between etch pit density and breakdown voltage is shown for LEC wafers. 52 refs., 19 figs., 1 tab.

3239 **(N—88-28095) As-received microstructure of a SiC/Ti-15-3 composite.** Lerch, B.A.; Hull, D.R.; Leonhardt, T.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Aug 1988. 27p. (NASA-TM—100938; E—4218; NAS—1.15:100938). NTIS, PC A03/MF A01.

A silicon carbide fiber reinforced titanium (Ti-15V-3Cr-3Sn-3Al) composite is metallographically examined. Several methods for examining composite materials are investigated and documented. Polishing techniques for this material are described. An interference layering method is developed to reveal the structure of the fiber, the reaction zone, and various phases within the matrix. Microprobe and transmission electron microscope (TEM) analyses are performed on the fiber/matrix interface. A detailed description of the fiber distribution as well as the microstructure of the fiber and matrix are presented.

3240 **(N—88-28323) New acousto-ultrasonic techniques applied to aerospace materials.** Kautz, H.E. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Aug 1988. 21p. (NASA-TM—101299; E—4281; NAS—1.15:101299; CONF-8808157—). NTIS, PC A03/MF A01.

From Non-destructive testing and evaluation for manufacturing and construction; Urbana, IL, USA (9 Aug 1988).

The use of an NdYAG pulsed laser for generating ultrasonic waves for NDE in resin matrix composites was investigated. A study was conducted of the use of the 1.064 micron wavelength NdYAG pulsed laser with the neat, unreinforced resin as well as graphite fiber/polymer composite specimens. In the case of the neat resins it was found that, at normal incidence, about 25 percent of the laser pulse energy was reflected at the incident surface. An attenuation coefficient for the polyimide resin, PMR-15 was determined to be approximately 5.8 np/cm. It was found in energy balance studies that graphite fiber/polymer specimens attenuate the laser beam more than do neat resins. The increase absorption is in the graphite fibers. The occurrence of laser induced surface damage was also studied. For the polymer neat resin, damage appears as pit formation over a small fraction of the pulse impact area and discoloration over a larger part of the area. A damage threshold was inferred from observed damage as a function of pulse energy. The 600 F cured PMR-15 and PMR-11 exhibit about the same amount of damage for a given laser pulse energy. The damage threshold is between 0.06 and 0.07 J/sq cm.

3241 **(N—88-28325) Two-dimensional sequential and concurrent finite element analysis of unstiffened and stiffened aluminum and composite panels with hole. Final report.** Razzaq, Z.; Prasad, V. (Old Dominion Univ., Norfolk, VA (USA)). Jul 1988. 57p. (NASA-CR—183083; NAS—1.26:183083). NTIS, PC A04/MF A01.

The results of a detailed investigation of the distribution of stresses in aluminum and composite panels subjected to uniform end shortening are presented. The focus problem is a rectangular panel with two longitudinal stiffeners, and an inner stiffener discontinuous at a central hole in the panel. The influence of the stiffeners on the stresses is evaluated through a two-dimensional global finite element analysis in the absence or presence of the hole. Contrary to the physical feel, it is found that the maximum stresses from the glocal analysis for both stiffened aluminum and composite panels are greater than the corresponding stresses for the unstiffened panels. The inner discontinuous stiffener causes a greater increase in stresses than the reduction provided by the two outer stiffeners. A detailed layer-by-layer study of stresses around the hole is also presented for both unstiffened and stiffened composite panels. A parallel equation solver is used for the global system of equations since the computational time is far less than that using a sequential scheme. A parallel Choleski method with up to 16 processors is used on Flex/32 Multicomputer at NASA Langley Research Center. The parallel computing results are summarized and include the computational times, speedups, bandwidths, and their inter-relationships for the panel problems. It is found that the computational time for the Choleski method decreases with a decrease in bandwidth, and better speedups result as the bandwidth increases.

3242 **(ORNL/Sub—85-22009/1) Transformation-toughened silicon nitride: Final report [1 June 1985--31 August 1987].** Carpenter, H.W. (Oak Ridge National Lab., TN (USA); Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). Aug 1988. Contract AC05-84OR21400. 132p. NTIS, PC A06/MF A01. Order Number TI89001311/JAW.

Composites, consisting of a silicon nitride (Si_3N_4) matrix containing dispersions of phase-stabilized zirconia (ZrO_2), were prepared by colloidal processing and sintering to near full density. These materials exhibited improved strength and increased fracture toughness relative to the matrix alone. The effects of ZrO_2 content, phase-stabilizer type and amount, and processing conditions on mechanical and thermophysical properties of the resultant composites were determined. The possibility of high-volume, low-cost production was demonstrated by successfully injection molding samples. A composite containing 45 w/o ({approximately} 30 v/o) ZrO_2 phase-stabilized with Y_2O_3 exhibited a 50% improvement in fracture toughness, high room temperature flexural strength, low thermal expansion, and low thermal conductivity. Use of Y_2O_3 plus SiO_2 as sintering aids with this composite was shown to maintain high strength to temperatures of 1400 C. A second system containing from 30 w/o ({approximately}20 v/o) to 45 w/o({approximately}30 v/o) ZrO_2 phase-stabilized with CaO also exhibited high fracture toughness and high strength. Further improvements (up to threefold) in fracture toughness were obtained by heat treatment. The CaO-containing system is limited to relatively low use temperatures of less than 700 C. Probable toughening due to the martensitic tetragonal to monoclinic transition of zirconia has been hypothesized. 15 refs., 42 figs., 20 tabs.

3243 **(PB—88-869458/XAB) Plastics and elastomers: radiation crosslinking. April 1986-September 1988 (Citations from the Rubber and Plastics Research Association data base). Report for April 1986-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 66p. NTIS PC N01/MF N01.

Supersedes PB—87-857025.

This bibliography contains citations concerning radiation-crosslinking processes for plastics and elastomers. Radiation sources and manufacturing processes are discussed, and the molecular structure and mechanical properties of the polymers are considered. Applications for paints, varnishes, adhesives, inks, and insulating coatings are presented. (This updated bibliography contains 82 citations, 15 of which are new entries to the previous edition.)

3244 (UCRL—53868-87, pp 6.1-6.5) **Ductile grinding of glass.** Blaedel, K.L.; Clouser, R.W.; Davis, P.J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

Ductile grinding can dramatically reduce the cost of fabricating large optics. However, much research must be done to determine the transition between ductile and brittle grinding. The authors have surveyed sites doing ductile grinding and have ground small glass samples at LLNL. In addition, they began to develop a number of techniques to permit the ductile grinding of glass. With continued effort, they should be able to ductile grind entire areas without incurring brittle fracture. Results to date are described.

3245 (UCRL—53868-87, pp 6.12-6.15) **Chip science: a basic study of the single-point cutting process.** Donaldson, R.R.; Riddle, R.A.; Syn, C.K.; Taylor, J.S. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors continued their study of precision machining with ultrasharp single-point cutting tools, the behavior of which significantly affects the quality of exotic manufactured components, such as radically aspheric optics used in directed-energy weapons research. This year they focused experiments in two areas: determining the minimum attainable depth of cut for a diamond tool edge, which ultimately limits the figure accuracy and minimum surface roughness attainable in single-point cutting, and studying the machinability of single-crystal silicon, a material of interest for cooled high-energy mirrors.

3246 (UCRL—53868-87, pp 7.1-7.5) **Residual stress for epoxy-resin composites.** Feng, W.W. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

In this study of residual stress in epoxy-resin composites caused by curing, the authors developed a micromechanics model. Assuming that epoxy is viscoelastic, he has written constitutive equations for viscoelastic materials in the incremental form and obtained a recurrence formula. Using accelerated tests for determining the viscoelastic material properties of polymeric materials at temperatures below the glass transition temperature, he determined the mechanical time- and temperature-dependent material properties of an epoxy. From the macromechanics point of view, the curvatures resulting from curing of thin, flat, asymmetric laminates are related to the residual strains in the micromechanics model. The author has designed an experimental apparatus to determine the residual stress and to confirm the accuracy of the analytical results. The author will use these results in future studies to minimize residual stress and to strengthen composite structures.

3247 (UCRL—99735) **Review of precision surface generating processes and their potential application to the fabrication of large optical components.** Stowers, I.F.; Komanduri, R.; Baird, E.D. (Lawrence Livermore National Lab., CA (USA)). 3 Oct 1988. Contract W-7405-ENG-48. 12p. (CONF-880887—26). NTIS, PC A03/MF A01. Order Number DE89001712/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

Over the last decade a wide variety of processes applicable to ultraprecision contouring and polishing have evolved. Examples of these processes include float polishing, elastic emission machining, erosive jet, ion milling, plasma assisted chemical etching, and precision ductile grinding. These processes are reviewed with the intent of comparing their removal rates, resultant surface roughness, demonstrated contour accuracy, and applicability to the manufacture of large optical components. The incentive for this study is the evolution of a deterministic manufacturing process able to lower the cost of fabricating large precision optical components by an order of magnitude. 45 refs., 13 figs.

3248 (ZfK—584, pp 45) **High energy (0.99 MeV) phosphorus implantation into silicon.** Skorupa, W.; Wieser, E.; Groetzschel, R.; Posselt, M.; Armigliato, A.; Garulli, A. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); CNR Istituto LAMEL, Bologna (Italy)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3249 (ZfK—584, pp 46) **Formation of buried silicon nitride layers in silicon by ion implantation - new results.** Skorupa, W.; Wollschlaeger, K.; Oertel, H.; Groetzschel, R.; Bartsch, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Akademie der Wissenschaften der DDR, Halle/Saale. Inst. fuer Festkoerperphysik und Elektronenmikroskopie). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3250 (ZfK—584, pp 47) **Anodic oxidation as sectioning technique for the determination of high dose B/sup +/ and As/sup +/ implantation profiles in Si.** Mende, G. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3251 **Cu^+ diffusion and interionic potentials for Cu^+ in alkali halides.** Meng, J.; Pandey, R.; Vail, J.M.; Kunz, A.B. (Physics Department, Michigan Technological University, Houghton, Michigan 49931). *Physical Review* [*Section*] *B: Condensed Matter;* **38**: No. 14, 10083-10086(15 Nov 1988).

Short-range interionic potentials for the substitutional Cu^+ ion in alkali fluorides and chlorides are derived using a methodology that provides self-consistent electronic-structure treatment of a molecular cluster of ions that includes the impurity, embedded in a shell model lattice. The derived potentials are used to calculate the activation energy for Cu^+ diffusion by the cation vacancy mechanism in these materials. For the only case where an experimental value is available, namely, $KCl:Cu^+$, satisfactory agreement is found.

3252 **Double bevel construction of a diamond anvil.** Moss, W.C. US Patent Application 6-011,977. 6 Feb 1987. 21p. Contract W-7405-ENG-48. DE89000087 NTIS, PC A03. Order Number DE89000087/JAW.

Use of double or multiple bevel culet geometry on a diamond anvil to provide increased sample pressure and stability for a given force applied to the diamond tables. 7 figs.

3253 **Mass transfer mechanisms for water adsorbed on silica gel.** Fraioli, A.V. (Argonne National Lab., Argonne, IL (US)). pp 23-30 of Solar energy technology. Murphy, L.M.; Guven, H.M.; Lowrey, P. New York, NY; American Society of Mechanical Engineers (1987). (CONF-871234—).

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

Water adsorption measurements were carried out on a commercial silica gel desiccant in humidistat tubes employing saturated salt solutions to maintain controlled final equilibrium partial pressures of water vapor over the adsorbent samples. The humidistat designs permitted measurement of adsorption in the air-saturated mode, or in the evacuated mode, where the vapor pressure of the water re-established by the wet salt slurry was the total gas pres-

sure of the system. Evaluation of the water adsorption data on silica gel obtained under both humidistat conditions disclosed a novel solid-side mass transport mechanism not previously considered in desiccant system modelling. It is proposed that at or about 40% relative humidity, pore flooding on the external surface creates a meniscal force imbalance with respect to the menisci adjacent to unfilled voids within the interior of the particle. At this point and beyond to saturation, fluid flow in a manner analogous to wicking saturates the particle, and appears to be responsible for the appearance of the "second knee" in the observed classical BET Type IV isotherm.

3254 **Continuum damage mechanics studies on the dynamic fracture of concrete.** Chen, E.P. (Sandia National Labs., Applied Mechanics Div. 1523, P.O. Box 5800, Albuquerque, NM (US)). pp 63-78 of Cement-based composites: Strain rate effects on fracture. Mindess, S.; Shah, S.P. Pittsburgh, PA; Materials Research Society (1986). (CONF-851217—).

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

The dynamic fracture of concrete in tension is studied by applying a continuum damage model developed by the author and his coworkers. In this model, the degree of damage in concrete corresponds to the fraction of concrete volume that has been tension relieved, and tensile microcracking has been taken as the damage mechanism. In compression, the concrete is assumed to respond in an elastic/perfectly plastic manner. Strain-rate effects have been explicitly included in the model. Accumulation of damage in the material is reflected by the progressive weakening of the material stiffness. Examples involving center- and edge-cracked plate specimens subjected to the action of step and ramp loads are used to demonstrate the material responses predicted by the model. The bulk pressure versus strain relationships at locations close to the crack tip clearly show strain-softening behavior. The damage tends to localize around the crack and its extent in the specimen is dependent upon both the crack geometry and the loading type. These results are presented and their implications are discussed.

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REFER ALSO TO CITATION(S) 2761, 2817, 3153, 3357, 3685, 3686, 3912

3255 **(AD-A—196260/4/XAB) Apparent fractional dimensionality of uranyl-exchanged zeolites and their photocatalytic activity. Technical report.** Yang, C.L.; El-Sayed, M.A.; Suib, S.L. (California Univ., Los Angeles (USA). Dept. of Chemistry and Biochemistry). 1987. 7p. (TR—57). NTIS, PC A02/MF A01.

Pub. in The Jnl. of Physical Chemistry, Vol. 91, 4440-4443(1987).

The temporal behavior of the intensity of an energy donor in the presence of energy acceptors distributed over a disordered lattice with dilation symmetry is predicted to give information about its fractal dimensionality. Using calculation and simulation, the authors have recently shown that the same procedure gives an apparent fractional dimensionality for lattices with translational symmetry possessing excluded volumes. In this letter, they have experimentally determined the apparent fractional dimensionality of four crystalline uranyl-exchanged zeolites from the observed decay of the uranyl ion(donor)emission in the presence of europium ions as acceptors. While no correlation is observed between the fractional dimensionality and the fraction of void or the energy-transfer efficiency on these four lattices, it is found that the zeolite with the lowest dimensionality is the most effective in the photocatalytical conversion of isopropyl alcohol to acetone.

3256 **(AD-A—196433/7/XAB) Laser-excited ionic fluorescence spectrometry of rare earth elements in the inductively coupled plasma.** Tremblay, M.D.; Smith, B.W.; Winefordner, J.D. (Florida Univ., Gainesville (USA). Dept. of Chemistry). 1987. 10p. NTIS, PC A02/MF A01.

Pub. in Analytica Chimica Acta, Vol. 199, 111-118(1987).

A pulsed tunable dye laser pumped with an excimer laser is used to excite ionic fluorescence of the rare earth elements in the inductively-coupled plasma. Because several fluorescence lines were observed after laser excitation, it was possible to draw partial energy-level diagrams for most of the rare earths. Non-resonance fluorescence lines were used for all measurements in order to minimize spectral interferences. Detection limits at given excitation wavelengths are reported for each element. Laser-excited ionic fluorescence eliminates the problem of spectral interferences which has been associated with determination of the rare earths by atomic emission spectrometry in the inductively-coupled plasma.

3257 **(AD-A—196882/5/XAB) Adsorbate effects on a mixed-valence compound: carbon monoxide chemisorption on $CeIr_2$.** Lindquist, J.M.; Hemminger, J.C. (California Univ., Irvine (USA). Dept. of Chemistry). 15 Oct 1987. 12p. NTIS, PC A03/MF A01.

Pub. in Physical Review B, Vol. 36, No. 11, 5819-5829(15 Oct 1987).

The authors studied the effects of stoichiometry change and CO chemisorption on the surface electronic structure of the mixed-valence compound $CeIr_2$. It is shown that the surface iridium to cerium ratio can be varied by changing sample temperature while sputtering. Carbon monoxide is found to adsorb 80% molecularly on the surface and cause a mild surface oxidation which induces a shift of electron density into available cerium f orbitals. Peaks due to the 4 sigma, 1 pi, and 5 sigma CO molecular orbitals appear at different binding energies than those due to molecular CO on the pure iridium surface. This binding-energy shift as well as the high percentage of molecular CO on the surface (CO adsorption on pure cerium is completely dissociative) points toward a surface which has lost much of the elemental character of its two constituents upon compound formation.

3258 **(AD-A—196883/3/XAB) CO chemisorption effects on cerium initial and final states in the core-level photoelectron spectrum of $CeIr_2$.** Lindquist, J.M.; Hemminger, J.C. (California Univ., Irvine (USA). Dept. of Chemistry). 1987. 4p. NTIS, PC A02/MF A01.

Pub. in The Jnl. of Physical Chemistry, Vol. 91, No. 22, 5535-5537(1987).

Carbon monoxide (CO) adsorption on the mixed-valence compound $CeIr_2$ has been studied by X-ray photoelectron spectroscopy. CO adsorption on this surface is predominantly molecular. We show that changes in the cerium 3d spectrum upon CO chemisorption may be separated into initial- and final-state effects. In the initial state, stabilization of the (Ce)(5d6s)34f1 configuration occurs due to an increase in effective nuclear charge on the cerium atom. This leads to a decrease in f0 intensity in the recorded spectrum. Increased f-electron repulsion in the final state raises the energy of the f2 final-state configuration and causes a 2.2-eV shift to higher binding energy of the 3d5/2f2 peak. The 0.5-eV binding energy shifts of the 3d5/2f1 and 3d3/2f1 peaks along with the 2.2-eV shift of the 3d5/2f2 peak indicate that the f orbitals are quite-sensitive indicators of the surface oxidation state in this compound.

3259 **(IEN-DQUI-DICOB—5/84) Determination of U(IV) by spectrophotometry.** Coutinho, C.M.C.; Bastos, E.T.R.; Bastos, M.B.R. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 27 Aug 1984. 7p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704247/JAW.

The determination of uranium (IV) concentration in acid solutions in the presence of U (IV), Fe (II) and Ti (IV) by spectrophotometry is studied, aiming at controlling the solutions in the ion exchange columns, used for uranium enrichment by isotope exchange. (E.G.).

3260 (INIS-BR—1275, pp 8) **Study of oxygen precipitation kinetic in Si:B monocrystals using X-ray techniques.** Bulla, D.A.P.; Stojanoff, V. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3261 **(INIS-BR—1298) Determination of U and Th by neutron activation techniques: application to rock analysis from Serra Geral formation.** Marques, L.S.; Molina, E.C.; Melfi, A.J.; Vasconcellos, M.B.A. (Sao Paulo Univ. (Brazil). Inst. Astronomico e Geofisico; Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704538/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

3262 **(INIS-BR—1339) Methodological study of volcanic glass dating by fission track method.** Araya, A.M.O. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1987. 76p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704798/JAW.

After a description of the method and from the analysis of the age equation we show the methodology used in the plotting of the correction curve and the results of the study of correction curves and corrected ages. From a study of the size correction method we see that the reactor irradiation effect on the curve is negligible and that the correction curve is independent of the thermal treatment but, it depends on chemical treatment and sample. Comparing the corrected ages obtained from both correction method and the ages given by other authors we can conclude that they are in agreement and concerning the plateau method, both isothermal and isochronic plateau give the same results.

3263 **(INIS-mf—11284) Trace element analysis of water using radioisotope induced X-ray fluorescence (Cd-109) and a preconcentration-internal standard method.** Alvarez, M.; Cano, W. (Universidad Nacional Pedro Henriquez Urena, Santo Domingo (Dominican Republic). Dept. de Fisica). Oct 1986. 19p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704266/JAW.

Radioisotope induced X-ray fluorescence using Cd-109 was used for the determination of iron, nickel, copper, zinc, lead and mercury in water. These metals were concentrated by precipitation with the chelating agent APDC. The precipitated formed was filtered using a membrane filter. Cobalt was added as an internal standard. Minimum detection limit, sensitivities and calibration curves linearities have been obtained to find the limits of the method. The usefulness of the method is illustrated analysing synthetic standard solutions. As an application analytical results are given for water of a highly polluted river area.

3264 **(INIS-mf—11835) Trace analyses for characterisation of the special metals vanadium, molybdenum, tantalum and tungsten, by means of activation analysis using neutrons and charged particles. Final report 1983/85.** Krivan, V. (Ulm Univ. (Germany, F.R.). Sektion Analytik und Hoechstreinigung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1986. 21p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755577/JAW.

Novel, efficient procedures have been developed and tested for trace analytical characterisation of the scientifically and technologically significant special metals vanadium, molybdenum, tantalium and tungsten. An important task within this project was the development of novel separation processes allowing selection and separation of individual indicator radionuclides, or specific groups of them, subsequent to activation. Special attention was placed on the trace element silicon which could not reliably be detected hitherto below amounts of $\leqq 1$ $\mu g/g$. So the methods developed extend detection limits up to two orders of magnitude, thus allowing further optimisation of manufacturing processes and better insight into the properties of these materials in dependence of the degree of purity.

3265 **(IPEN-Pub—148) Voltametric determination of O:U relation in uranium oxide.** Carvalho, F.M.S. de; Abrao, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 11p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704275/JAW.

Uranium oxide samples are dissolved in hot concentrated H/sub 3/PO/sub 4/ - H/sub 2/SO/sub 4/ mixture and the solution diluted with 1M H/sub 2/SO/sub 4/. One aliquot of such solution (A) is used to record the first voltamogram which gives the U(VI) content. To a second aliquot HNO/sub 3/ and H/sub 2/O/sub 2/ is added to oxidise uranium to the hexavalent state (B) and the second voltamogram is recorded from 0.0 to 0.4 V X SCE. The O:U ratio in the original sample is calculated by the expression: O/U = 2.000 + [U (VI) soln.A/% U(VI) soln. B]. The method provides an accurate means for determining O to U ratios in high-purity uranium dioxide, fuel pellets and a variety of oxides prepared for developmental work on ceramic fuel materials.

3266 **(IPEN-Pub—163) Determination of contaminants in boric acid used as neutron moderator by means of ion chromatography and selective electrodes.** Pires, M.A.F.; Abrao, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 14p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704279/JAW.

The boric acid used as neutron moderator in reactors must observe restrictions about the concentration of some impurities. According to Westinghouse (1) specification, the highest limits for sodium, sulphate, phosphate, fluoride, and chlorine are: Na/sup +/ - 0,003%; SO/sub 4//sup -2/ - 0,0006%; PO/sub 4//sup -3/ - 0,003%; F/sup -/ - 0,00002%; Cl/sup -/ - 0,00004%. This paper describes the determination of ions above mentioned directly in the boric acid solution. The sample is dissolved in water or in an appropriate eluent and is injected in the ion chromatograph. Na/sup +/ and F/sup -/ are determined by means of selective electrodes. The determination limits found for F/sup -/ (0,0002%) and Cl/sup -/(0,0002%) are not sufficiently low to attent the specifications. The determination limits found for SO/sub 4//sup -2/ (0,0005%), PO/sub 4//sup -3/ (0,0003%) and Na/sup +/(0,0005%) are good enough for nuclear pure boric acid analysis. In some samples nitrate (detection limit 0,0015%) was found as well. Boric acid from different suppliers were analysed.

3267 **(IPEN-Pub—173) Application of neutron actication analysis to the determination of impurities in rare earth oxides produced at IPEN-CNEN/SP.** Saiki, M.; Oliveira Lellis, L. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 15p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704281/JAW.

This paper describes a method for trace analysis in high purity rare earth oxides. This method is an application of instrumental neutron activation analysis. The results of analysis obtained in La/sub 2/O/sub 3/, CeO/sub 2/, Pr/sub 6/O/sub 11/ Nd/sub 2/O/sub 3/, Sm/sub 2/O/sub 3/ and Gd/sub 2/O/sub 3/ produced at IPEN-CNEN/SP are presented. A detailed study of the possible interference found in the neutron activation of these materials is also made. The sensitivity of the method is determined for impurities not detected in each sample.

3268 **(JINR—18-87-870) Element analysis and radiography with neutron resonance filters.** Teterev, Yu.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704837/JAW.

Submitted to the journal At. Energy.

Real possibilities of a selecting reducing the activation at screening with resonance filters of geological samples of a large mass (about 50 g) are shown. The analytical expression obtained for calculating the screening efficiency taking into account neutron scattering in filter material and in a sample study is given. Experimental results confirming the reliability of the calculations are presented. Strong dependence of screening efficiency on sample scattering properties was used for development of new methods: for

determining the content of light elements and carrying out the neutron radiography. New methods of determination of hydrogen content are described. The detection limit equal to 0.015 g of hydrogen in geological sample having 40-70 g mass is achieved by using /sup 252/Cf neutron source with 5x10/sup 7/ neutron per sec yield. Time of analysis was 2-3 min. Analysis results do not depend on matrix composition. A new method of neutron radiogarphy has a contrast sensitivity 5-10 times higher as compare to the traditional one. 10 refs.; 2 figs.

3269 **(LA-UR—88-3492) Channeled and microactiviation of materials.** Maggiore, C.J.; Blacic, J.D.; Blondiaux, G.; Debrun, J.L.; Ali, M.H.; Mathez, E.; Misdaq, M.A.; Valladon, M. (Los Alamos National Lab., NM (USA); Centre National de la Recherche Scientifique, 45 - Orleans-la-Source (France); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; American Museum of Natural History, New York; Rabat Univ. (Morocco)). 1988. Contract W-7405-ENG-36. 12p. (CONF-881151—23). NTIS, PC A03/MF A01. Order Number DE89002055/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Charged particle activation analysis can be combined with channeling to determine lattice location of impurities at the trace level in single crystal samples. It can also be used with a nuclear microprobe to measure impurities at trace levels in small or spatially inhomogeneous samples. Examples of these extensions of activation analysis to realistic samples are carbon determination in organometallic vapor phase epitaxial layers of GaAlAs on GaAs and oxygen determination in diamonds. 5 refs., 2 figs.

3270 **(MINTEK-TR—1272) Process development for economical processing of various vanadium-bearing raw materials.** Retelsdorf, H-J.; Rothmann, H.; Fichte, R. (Council for Mineral Technology, Randburg (South Africa)). [1987]. 13p. Mintek, P O Box X3015, Randburg, 2125, South Africa.

Translated from Gesellschaft fur Electrometallurgie m.b.H, Dusseldorf, June 1982. Original report number: BMFT-FB-T 82-097.

Three different vanadium-containing byproducts were investigated, with the object of extracting the vanadium economically. Leach residues are formed in the known treatment of vanadium-containing blast furnace slags. It was found possible, by means of reduction with carbon in an electric arc furnace, to carry over 73,5% of the input vanadium into the metal alloy which in addition to 67% Fe and 2% V also contains 7% Cr and 5,5% C. Vanadium-containing fly ash results from the combustion of crude oil. This contains 0,5 to 6 % V. Tests on several processes, such as oxidising roast with subsequent leaching, reducing roast with subsequent leaching with sulphuric acid, and alkali soda roasting, gave widely varying results on the fly ash derived from various sources. The most suitable method must be worked out individually for each material. Vanadium-containing waste salt results from the recovery of aluminium from bauxites. It contains an average of about 4% V and 5% P, as well as 0,5% As. Dissolution of the waste salt in water with the addition of sulphuric acid results in a solution containing 20 g/1 V, from which, after removal of the phosphorus, ammonium polyvanadate can be precipitated by known means. In addition to the recovery of the vanadium the object is also to obtain a saleable phosphorus-containing product. After dissolution and neutralisation of the waste salt, it is possible to obtain with phosphoric acid a secondary sodium phosphate which, however, even after recrystallisation, does not satisfy the purity requirements of the detergent industry. The sodium sulphate/phosphate resulting from the neutralisation with sulphuric acid cannot be used by the phosphate industry, although the secondary sodium phosphate can be so used. A calculation shows however that with this the vanadium recovery is no longer economic.

3271 **(PB—88-240528/XAB) Processing technologies for extracting cobalt from domestic resources. Information Circular/1988.** Jordan, C.E. (Bureau of Mines, Tuscaloosa, AL (USA). Tuscaloosa Research Center). 1988. 31p. (BM-IC—9176). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600331.

A summary of the cobalt processing technologies for the major domestic resources is presented. The processing technologies for the Blackbird, Madison Mine, Duluth Gabbro, iron ore pyrite, laterites, and manganese sea nodules are nearly complete, but the economics are not favorable. Research on these resources should be limited to approaches that promise to cut the total processing costs by at least 50 pct. The most-promising sources of cobalt are the spent-copper leach solutions and siegenite from the Missouri lead ores. Research on cobalt processing from these two sources needs to be completed.

3272 **(PB—88-245881/XAB) Capillary column gc-ms determination of 77 purgeable organic compounds in two simulated liquid wastes.** Yancey, M.F.; Kornfeld, R.A.; Warner, J.S. (Battelle Columbus Div., OH (USA)). Aug 1988. 80p. NTIS, PC A05/MF A01.

The suitability of purge-trap-desorb (PTD) procedures for determination of 84 volatile organic compounds with capillary column gas chromatograph (GC) and mass spectrometry (MS) was evaluated. After collecting GC-MS data not previously available for some analytes, 7 of the 84 compounds were eliminated from further consideration because of poor purging efficiency or analyte instability. For each of the remaining 77 compounds, the linear concentration range and detection limit were determined with data obtained by PTD GC-MS analysis of spiked reagent water. The criterion was met over a concentration range of at least two orders of magnitude for 56 of the 77 analytes, 1.5 orders of magnitude for 12 analytes, and 1 order of magnitude for 6 analytes. The criterion was not met for acetone, trichlorofluoromethane, and 2-chloro-1,3-butadiene. Method performance was assessed by analyzing eight replicate aliquots of two simulated liquid-waste samples (a municipal sewage-sludge leachate and water containing fulvic acid) containing analytes spiked at two concentrations.

3273 **Method for extracting copper, silver and related metals.** Moyer, B.A.; McDowell, W.J. US Patent Application 6-111,490. 23 Oct 1987. 11p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A process for selectively extracting precious metals such as silver and gold concurrent with copper extraction from aqueous solutions containing the same. The process utilizes tetrathiamacrocycles and high molecular weight organic acids that exhibit a synergistic relationship when complexing with certain metal ions thereby removing them from ore leach solutions.

4002 Inorganic, Organic And Physical Chemistry

REFER ALSO TO CITATION(S) 2745, 2747, 2751, 2755, 2760, 2788, 3233, 3234, 3237, 3291, 3293, 3687

3274 **(AD-A—196824/7/XAB) Kinetics of boron hydride interconversion reactions. Periodic report nos. 1-5.** Greenwood, N.N. (Leeds Univ. (UK)). May 1988. 28p. NTIS, PC A03/MF A01.

The mechanisms by which gaseous boron hydrides so readily interconvert and build up into larger clusters has excited considerable academic and industrial interest for several decades. This paper describes recent progress that has been made in unravelling this complex series of interconversion reactions. Initial reaction rates were studied mass spectrometrically to obtain rate equations, orders of reaction, and energies of activation. Detailed and continuous product analysis for H_2 and all the volatile boranes formed, coupled with a study of cothermolysis reactions of selected pairs of boranes gives further insight into the processes occurring. Crucial aspects of the thermolysis of B_2H_6, B_4H_{10}, B_5H_{11}, and B_6H_{10} are discussed, as are the effects of added H_2 and the cothermolysis of B_6H_{10} with alkenes. The final section presents data on the UV absorption spectra and photolytic stability of eight volatile boranes and the reaction kinetics of B_6H_{10} photolysis.

3275 **(CEGB-TPRD/B—1065/R87) Cobalt adsorption on zirconia and haematite at low temperatures.** Walker, S.M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jun 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755476/JAW.

Adsorption of cobalt on haematite and zirconia has been studied in the temperature range 298 to 328K, with room temperature pH values between 6.6 and 8.0. The ionic strength was kept constant for most of the experiments at 0.1M, using sodium nitrate, although the effect of altering it was investigated briefly. The extent of cobalt adsorption on haematite and zirconia was found to increase with temperature, with pH, and with decreasing ionic strength. As the PWR primary coolant pH is raised, it is likely that cobalt uptake on zirconia films will increase, but the extent of the adsorption cannot be predicted from the present study. A series of autoclave experiments is therefore planned to study cobalt uptake as a function of water chemistry at temperatures representative of the PWR primary coolant.

3276 **(CEGB-TPRD/L—3262/R88) Concentration of involatile salts at evaporating water surfaces.** Gardner, G.C. (Central Electricity Research Labs., Leatherhead (UK)). Feb 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755478/JAW.

Safety cases for the PWR often need to know how much of the soluble salts in the water will evaporate with the steam during flashing and when the steam is discharged to the atmosphere. Some ideal evaporating systems to give guidance. Simple formulae are derived for the surface concentration relative to the bulk concentration. An analysis is also presented which derives a formula for the mass transfer process in the steam due to both diffusion and convection, which arises from the evaporation process. The convection process will usually dominate.

3277 **(DOE/ER/13552—2) Some analysis and algorithms for multistage separation processes.** Sridhar, L.N.; Lucia, A. (Clarkson Univ., Potsdam, NY (USA). Dept. of Chemical Engineering). Jun 1988. Contract FG02-86ER13552. 47p. NTIS, PC A03/MF A01. Order Number DE89001785/JAW.

Multistage equilibrium separation processes involving binary homogeneous mixtures are analyzed. For several sets of specifications, it is shown that these process models admit a unique steady-state solution without the need for a constant molar overflow assumption or other energy balance or phase equilibria simplifications. The steady-state model equations are analyzed directly. Consequently, the analysis is constructive and gives insight into the behavior and development of algorithms for solving multistage separation process model equations in both the binary and multicomponent cases. To illustrate this, a new generalized Broyden acceleration technique is developed and used in the context of a sum-rates algorithm to solve several example problems. Numerical results show that the proposed acceleration method is comparable to Newton acceleration and clearly outperforms traditional Broyden acceleration. Other properties predicted by the analysis are also illustrated. 21 refs., 4 figs.

3278 **(DOE/ER/13582—T1) Study of improved methods for predicting chemical equilibria: Technical progress report for the period 1 September 1987--31 August 1988.** Lenz, T.G.; Vaughan, J.D. (Colorado State Univ., Fort Collins (USA)). 1988. Contract FG02-86ER13582. 6p. NTIS, PC A02/MF A01. Order Number DE89002680/JAW.

Two continuing and important objectives of computational chemists and chemical engineers are first, to predict accurately the feasibility and extent of chemical reactions, and second, to predict accurately the rate of approach to chemical equilibrium for these reactions. The focus of our research presently is on the first of these objectives. Our specific objective is to calculate thermodynamic properties of typical organic reactions in liquid solution at various temperatures, and hence, to calculate equilibrium concentrations of the reactants and products at these temperatures. The reacting systems being investigated at this time are Diels-Alder condensations of anthracene dienes and maleic anhydride dienophiles in solvents.

3279 (INIS-BR—1275, pp 3) **X-ray diffraction studies of some 1 - acylindolines.** Martins, V.C.A.; Goissis, G.; Arni, R.K.; Mascarenhas, Y.P. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3280 (INIS-BR—1275, pp 4) **Crystal and molecular structures of the triterpene from austroplenckia populnea (celastraceae) cortex.** Cota, A.B.; Mascarenhas, Y.P.; Sousa, J.R. de. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica; Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Quimica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3281 (INIS-BR—1275, pp 5) **Crystal and molecular structures of Ni complex.** Cota, A.B.; Mascarenhas, Y.P.; Franco, C.V.; Levy, N.N. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica; Santa Catarina Univ., Florianopolis (Brazil). Dept. de Quimica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3282 (INIS-BR—1275, pp 6) **Growth and morphological characterization of o-acetamide benzoic acid crystals.** Lechat, J.R.; Silva, A.A. da. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3283 (INIS-BR—1275, pp 18) **X-ray powder diffraction data for sodium octyl-sulfate sodium decyl sulfate and sodium dodecyl sulfate.** Bittencourt, D.R.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3284 **(LA-UR—88-3243) Coupled sulfur isotopic and chemical mass transfer modeling: Approach and application to dynamic hydrothermal processes.** Janecky, D.R. (Los Alamos National Lab., NM (USA)). 21 Sep 1988. Contract W-7405-ENG-36. 11p. (CONF-881240—1). NTIS, PC A03/MF A01. Order Number TI89000345/JAW.

From Chemical modeling in aqueous systems II; San Francisco, CA, USA (5 Dec 1988).

A computational modeling code (EQPS←S) has been developed to examine sulfur isotopic distribution pathways coupled with calculations of chemical mass transfer pathways. A post processor approach to EQ6 calculations was chosen so that a variety of isotopic pathways could be examined for each reaction pathway. Two types of major bounding conditions were implemented: (1) equilibrium isotopic exchange between sulfate and sulfide species or exchange only accompanying chemical reduction and oxidation events, and (2) existence or lack of isotopic exchange between solution species and precipitated minerals, parallel to the open and closed chemical system formulations of chemical mass transfer modeling codes. All of the chemical data necessary to explicitly calculate isotopic distribution pathways is generated by most mass transfer modeling codes and can be input to the EQPS code. Routines are built in to directly handle EQ6 tabular files. Chemical reaction models of seafloor hydrothermal vent processes and accompanying sulfur isotopic distribution pathways illustrate the capabilities of coupling EQPS←S with EQ6 calculations, including the extent of differences that can exist due to the isotopic bounding condition assumptions described above. 11 refs., 2 figs.

3285 **(LA-UR—88-3550) MoS_2 interactions with 1--3 eV atomic oxygen.** Martin, J.A.; Cross, J.B.; Pope, L.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-881155—5). NTIS, PC A02/MF A01. Order Number DE89002300/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Exposures of MoS_2 to 1.5--3 eV atomic oxygen in an anhydrous environment reveal that the degree of oxidation is essentially independent of crystallite orientation and the surface adsorbed reaction products are MoO_3 and MoO_2. A mixture of oxides and sulfide exist over a depth of at least 100 {angstrom} and this layer has a low diffusion rate for oxygen. It is concluded that a protective oxide layer will form on MoS_2 upon exposure to the atomic-oxygen-rich environment of low earth orbit. The tribological implications of these results are under investigation. 8 refs., 3 figs.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 2821

4005 Photochemistry

REFER ALSO TO CITATION(S) 3288

3286 **(AD-A—196333/9/XAB) T-v energy transfer and chemical reactions of laser-produced hot H and D atoms.** Cousins, L.M.; Leone, S.R. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). 1988. 4p. NTIS, PC A02/MF A01.

Pub. in Radiochimica Acta, Vol. 43, 107-109(1988).

Laser photolysis of various molecular precursors provides a means to generate translationally fast H and D atoms with laboratory energies in the range of 1 - 3 eV. Because of the large disparity in the mass of the H atom compared to the mass of the other photolysis fragment, almost all of the excess energy of the photon is deposited into the kinetic energy of the light H atom. From conservation of energy and momentum, the energy of the H atom may be calculated almost exactly. With typical precursors such as HI, HBr, HCl, and H_2S, and excimer laser wavelengths at 193 and 248 nm, the widths of the H atom kinetic energy distributions are small compared to the total energies, providing a rather precise collision energy.

3287 **Multiconfiguration Hartree-Fock calculation for the bound-free photodetachment cross section of H^-.** Saha, H.P. (Department of Physics, University of Central Florida, Orlando, Florida 32816-0993). *Physical Review [Section] A: General Physics;* **38**: No. 9, 4546-4551(1 Nov 1988).

The photodetachment cross section of the H^- ion has been obtained with the multiconfiguration Hartree-Fock method extended to compute the multiconfiguration Hartree-Fock continuum wave function. The electron correlation and polarization effects that are very important for photodetachment cross-section calculation have been taken into account in an ab initio manner through the configuration-interaction procedure. Our results are compared with other accurate and elaborate theoretical calculations and with experiment. It is found that the present results are in excellent agreement with experiment throughout the range of energies considered. The theoretical results obtained by other accurate methods are also in very close agreement with the present results.

4006 Radiation Chemistry

3288 **(DOE/ER/00038—3136) University of Notre Dame Radiation Laboratory quarterly report, July 1, 1988--September 30, 1988.** (Notre Dame Univ., IN (USA). Radiation Lab.). 13 Oct 1988. Contract AC02-76ER00038. 45p. (NDRL—3136; Q—125). NTIS, PC A03/MF A01. Order Number DE89001787/JAW.

Abstracts of research performed at the University of Notre Dame's Radiation Laboratory are presented. (CBS)

3289 **(ITEF—201(1987)) On mechanism of radiolytic hydrogen formation in liguid cyclohexane.** Byakov, V.M.; Nichiporov, F.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704821/JAW.

Results of determining radiation chemical yield of hydrogen, which occurs during liquid cyclohexane irradiation by intensive 20 MeV proton beam (dose rate (DR) in 1.3X10/sup 7/ - 1.3X10/sup 10/ Gy/s range) are presented. The common G(H/sub 2/) dependence of DR irrespectively of LET of radiations was demonstrated in 10/sup -2/ - 13 eV/A range. It points to the fact that hydrogen formation takes place in result of volumetric, but not intratrack reactions. Quantitative description of G(H/sub 2/) dependence on DR is possible if it is assumed that tripletly excited cyclohexane molecules with ≥10/sup -4/ s lifetime represent hydrogen precursors. 14 refs.; 2 figs.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 3601

3290 **(BNL—41768) Nuclear medicine applications: Summary of Panel 4.** Wolf, A.P. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 7p. (CONF-8802113—2). NTIS, PC A02/MF A01. Order Number DE89001100/JAW.

From Workshop on training requirements for chemists in nuclear medicine, nuclear industry and related areas; Washington, DC, USA (3 Feb 1988).

Nuclear medicine is currently facing a desperate shortage of organic and inorganic chemists and nuclear pharmacists who also have advanced training in nuclear and radiochemistry. Ironically, this shortfall is occurring in the face of rapid growth and technological advances which have made the practice of nuclear medicine an integral part of the modern health care system. This shortage threatens to limit the availability of radiopharmaceuticals required in routine hospital procedures and to impede the development of new diagnostic and therapeutic agents. To redress this need and prevent a similar shortfall in the future, this panel recommends immediate action and a long-term commitment to the following: educating the public on the benefits of nuclear medicine; informing undergraduate and graduate chemistry students about career opportunities in nuclear medicine; offering upper level courses in nuclear and radiochemistry (including laboratory) in universities; establishing training centers and fellowships at the postgraduate level for specialized education in the aspects of nuclear and radiochemistry required by the nuclear medicine profession. 1 tab.

3291 **(FEI—1855) Some kinetic regularities of different-valence ion exchange on phosphonic acid cationite.** Razbash, A.A.; Sevast'yanov, Yu.G.; Kuz'mina, M.A.; Bykhovskij, D.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01.

The static method and the example of cadmium(2), cerium(3) and thorium(4) are used to study the establishment of equilibrium during sorption of different-valent ions on a macroporous phasphonic acid cationite KRF-20t-60. It is shown that the increase of ion valence brings about the increase in the time of establishing equilibrium. It is found that cadmium(2) and cerium(3) sorption is determined by mixed diffusion kinetics. Thorium(4) sorption at the initial stage is mainly determined by external diffusion process. Moreover, the rate of thorium absorption is primarily connected with comparatively slow diffusion in the cationite state. 3 refs.; 11 figf.

3292 **(INIS-mf—11323) Technetium. Chemistry and applications.** (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1988. 9p. (In German). (CONF-8805217—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704560/JAW.

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

15 contributions are presented as titles with abstracts. The following subject areas are dealt with: chemical preparation and characterization of /sup 99/Tc complexes, structural chemical analysis of /sup 99/Tc complexes using modern physical methods, and applications of /sup 99/Tc complexes in nuclear medicine.

3293 **(NIIAR—3(714)) Thermoanalytical device DTA-6D for actinide compound investigation.** Radchenko, V.M.; Egunov, V.P.; Izmalkov, A.N.; Vasil'ev, V.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704885/JAW.

Consideration is being given to the DTA-6D device for differential thermal analysis, enabling to deal with lanthanide and actinide compounds in 20-1000 deg. C range with 0.01-3.0 deg.C/s heating rate in atmosphere of various gases. Performance and principle of operation of the device are presented. Oxidation of metallic lanthanum in oxygen at 20-800 deg.C was investigated in order to test the device operationability and the effect of some parameters on the process of oxidation of metallic lanthanides and actinides. It is shown that only the surface layer of compact sample is oxidized in the given temperature range, meanwhile fine-grained powders (0.1-1.2 mm particle size) burn in oxygen flow with formation of A-form of LaO/sub 1.5/. The decrease of heating rate from 1.0 down to 0.1 deg.C/s results to the displacement of temperatures of metal oxidation initiation and thermal effect peaks to the region of lower temperatures with simultaneous reduction of thermal effect intensities. 9 refs.; 3 figs.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 2791

3294 **(PB—88-245410/XAB) Fluidized bed combustion of a single carbon particle. Doctoral thesis.** Prins, W. (Technische Univ. Twente, Enschede (Netherlands)). 1987. 260p. NTIS, PC E10/MF A01.

Summary in Dutch.

To date, fluidized-bed combustion (FBC) has been widely accepted as a clean, efficient, and flexible technique for the conversion of various solid fuels. The study described in this thesis is focused on the combustion behavior of a single carbon particle, as found dispersed in the inert bulk material of a fluidized bed during continuous operation as a coal combustor. Preceeding the main research work done, a global exploratory study of single coal particle behavior was performed through visual observation of a two-dimensional fluidized-bed construction at elevated temperatures. Topics of the study were coal-particle fracture, mixing with the bed, tar release, evolution, ignition and combustion of volatiles, and ignition of char. Several new phenomena have been observed.

42 ENGINEERING

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 2753, 2754, 2786, 2901, 3003, 3148, 3165, 3252, 3319, 3403, 4010, 4016, 4027

3295 **(AD-A—195965/9/XAB) Microprocessor control of quarter-watt linear cooler. Final report, 5 December 1986-31 July 1987.** (Magnavox Government and Industrial Electronics Co., Mahwah, NJ (USA). Electro-Optical Systems). 7 Aug 1987. 27p. (EOSR—1552). NTIS, PC A03/MF A01.

The purpose of the program was to conduct studies of microcontroller/digital VLSI technologies for possible future use in cryogenic coolers. A necessary condition that any electronic approach must satisfy in order to be considered for linear-cooler electronics is the ability to work in the real-time environment of 100 kHz or higher switching speeds. In the case of the existing analog design, this prerequisite has long been established to achieve practically sized line filters. Heretofore, this speed was out of reach of microprocessor-based, controllers since the state-of-the-art was somewhere in the neighborhood of 8 to 10 kHz. However, a new device on the market has provided the necessary interface hardware to bridge this gap. This advancement combined with the advances of microcontrollers in terms of cost, size, and performance suggested that an investigation of the microcontroller/digital approach for the Magnavox quarter-watt cooler electronics be performed.

3296 **(AD-A—196958/3/XAB) Thermodynamic improvements for the space thermo-acoustic refrigerator (STAR). Master's thesis.** Susalla, M.P. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1988. 172p. NTIS, PC A08/MF A01.

The objective of the STAR project is to test and space qualify a new continuous-cycle cryogenic refrigeration system for cooling of sensors and electronics which is based upon the newly discovered thermoacoustic heat-pumping effect. The new refrigerator has no sliding seals, a cycle frequency of about 300 Hz, and uses acoustic resonance to enhance the overall power density and efficiency. This thesis is concerned specifically with the design and testing of the thermodynamic element (or stack), which is responsible for the thermo-acoustic power conversion, and the testing of binary inert-gas mixtures as working fluids. Using the refrigerator's coefficient of performance relative to the ideal Carnot coefficient of performance as a measure of efficiency, a 93% improvement over previous designs.

3297 **(BNL—41817) Orientation dependent x-ray absorption in high T/sub c/ superconductors.** Heald, S.M.; Tranquada, J.M.; Yang, C.Y.; Xu, Youwen; Moodenbaugh, A.R.; Subramanian, M.A.; Sleight, A.W. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016;AS05-80ER10742. 3p. (CONF-8808149—3). NTIS, PC A02/MF A01. Order Number DE89002910/JAW.

From 5. international conference on X-ray absorption fine structure; Seattle, WA, USA (21 Aug 1988).

Orientation dependent x-ray absorption measurements have been on a number of high-T/sub c/ superconductors using powders oriented in a magnetic field. Both the near edge and EXAFS show a strong orientation dependence which has proven very useful in understanding these anisotropic materials. 5 refs., 1 fig., 1 tab.

3298 **(CONF-881208—3) Optimal control of uncertain nonlinear systems: An application to a two-link robotic arm.** March-Leuba, C.; Perez, R.B. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number TI89001490/JAW.

From 27. IEEE conference on decision and control; Austin, TX, USA (7 Dec 1988).

This paper presents an adaptive optimal control algorithm for uncertain nonlinear systems. A variational technique based on Pontryagin's Maximum Principle is used to track the system's unknown terms, and to calculate the optimal control. The reformation of the variational technique as an initial value problem allows this microprocessor-based algorithm to perform as a closed-loop controller by updating the model and controlling the system on-line. To validate the algorithm a system representing a two-link mechanical manipulator is simulated. In the control model, the coupling and friction terms are unknown. The robot's task is to follow a prescribed trajectory and to pick up an unknown mass. 3 refs., 1 fig.

3299 **(DOE/ET/27144—T1) A laboratory instrument developed to measure properties of drilling fluids under extreme geothermal conditions: Final report.** (NL Baroid, Inc., Houston, TX (USA)). [1983]. Contract AC04-77ET27144. 101p. NTIS, PC A06/MF A01. Order Number DE89002250/JAW.

A test system has been built to measure the properties of drilling fluids under extreme geothermal conditions. The system has been designed to measure density, rheology, corrosion and filtration rate at temperatures up to 700{degree}F and pressures up to 20,000 psi. This one-of-a-kind drilling fluids test system was jointly funded by NL Industries, Inc. and the US Department of Energy. It has been designated the DYNAMIC HPHT{trademark} Test System. A pressure vessel composed of low-alloy carbon gun steel encloses the system's instruments during a test. The DYNAMIC HPHT drilling fluids test system makes four basic measurements of fluids under pressure and temperature: rheology, filtration rate, corrosion rate and density. Rheology is measured by a rotary drilling fluids rheometer with special methods of motivation and torque measurement. Filtration measurements are accomplished by a 5 micron stainless steel filter medium, vertically mounted in a moving mode, supplemented by a frontal shear bob and continuous external filtrate collector. Density is measured by computer comparison of the weight of a stainless steel bob to its weight in air. A specially designed electrode sensor system is combined with an electronics package to measure corrosivity. Linear polarization of the sensors provides a series of intermittent corrosion readings throughout the test period. 8 figs.

3300 **(DOE/NV/10322—34) Shaft drilling at the Nevada Test Site.** Schwichtenberg, D.R. (Fenix and Scisson, Inc., Mercury, NV (USA)). Oct 1988. Contract AC08-84NV10322. 39p. (CONF-8810214—1). NTIS, PC A03/MF A01. Order Number DE89002287/JAW.

From Shaft drilling short course; Golden, CO, USA (12 Oct 1988).

Numerous areas of shaft drilling equipment, practices, and ideas are discussed, based primarily on drilling operations as carried on under the general management of the US Department of Energy at the Nevada Test Site (NTS). The organizational structure for drilling work at the Test Site is presented. The geological formations, in general terms, of those areas of the Test Site in which shafts are drilled on a 24-hour-per-day basis, are examined. Some of the history of shaft drilling development at the Test Site is reviewed, and current shaft drilling machinery and techniques are addressed. Several current ideas for improvements in shaft drilling are presented. Some of these innovations will likely produce only a few percentage points increase in shaft drilling efficiency, while one of them could eventually prove to be a quantum jump in shaft drilling technology, especially for those engaged in drilling shafts in the harder rock formations. 19 figs.

3301 **(DPST—86-171-11) Response to in-depth safety audit of the L Lake sampling station.** Gladden, J.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 15 Oct 1986. Contract AC09-76SR00001. 3p. NTIS, PC A02/MF A01. Order Number DE89002496/JAW.

An in-depth safety audit of several of the facilities and operations supporting the Biological Monitoring Program on L Lake was conducted. Subsequent to the initial audit, the audit team evaluated the handling of samples taken for analysis of Naegleria fowleri at the 704-U laboratory facility.

3302 **(EGG—10617-5007) The Midland fiber-optic analog transmission system development project (FATS).** Baumgart, J.S.; Anaya, R.; Morris, G. (EG and G Energy Measurements, Inc., Los Alamos, NM (USA). Los Alamos Operations). Jul 1988. Contract AC08-88NV10617. 135p. NTIS, PC A07. Order Number DE88014118/JAW.

This report was written to document the overall effort related to the development and testing of the various components comprising the fiber optic analog transmission system (FATS) and to the validation of the FATS itself. The overall project was approached as a joint effort between the Los Alamos National Laboratory; the Atomic Weapons Research Establishment (AWRE); and EG&G Energy Measurements. The ultimate goal of the project was to develop a system, based on laser diodes and a streak camera system, to measure alpha. Although the FATS was not fielded on the MIDLAND event, in the course of the project we did in fact answer technology questions identified on previous experiments and develop a better understanding of system needs. We hope that the information contained in this report will provide a basis for planning future experiments, as well as defining the direction for additional laboratory measurements. 94 figs.

3303 **(LA-UR—88-3471) Statistical efforts for Los Alamos Crew Member Lethality Program.** Bement, T.R.; Picard, R.R.; Peck, C.E.; Moore, L.M.; Hemphill, G.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8810215—1). NTIS, PC A03/MF A01. Order Number DE89002125/JAW.

From Live fire crew casualty assessment workshop; Gaithersburg, MD, USA (18 Oct 1988).

To date the Crew Member Lethality Program at Los Alamos has involved 42 behind armor effects tests conducted at Kirkland Air Force Base, New Mexico. Data management for these tests has involved a series of activities ranging from experimental design to data file organization, with an objective of recording relevant test parameters and data and of providing the capability to perform theoretically sound statistical analyses in an efficient manner. This paper describes the approach that has been taken and anticipated future directions. 8 refs., 3 figs., 2 tabs.

3304 **(LBL—25777) A unique cabling designed to produce Rutherford-type superconducting cable for the SSC project.** Grisel, J.; Royet, J.M.; Scanlan, R.M.; Armer, R. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 4p. (CONF-880812—22). NTIS, PC A02/MF A01. Order Number DE89002666/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

Up to 25,000 Km of keystoned flat cable must be produced for the SSC project. Starting from a specification developed by Lawrence Berkeley Laboratory (LBL), a special cabling machine has been designed by Dour Metal. It has been designed to be able to run at a speed corresponding to a maximum production rate of 10 m/min. This cabling machine is the key part of the production line which consists of a precision Turkshead equipped with a variable power drive, a caterpillar, a dimensional control bench, a data acquisition system, and a take-up unit. The main features of the cabling unit to be described are a design with nearly equal path length between spool and assembling point for all the wires, and the possibility to run the machine with several over- or under-twisting ratios between cable and wires. These requirements led Dour Metal to the choice of an unconventional mechanical concept for a cabling machine. 4 refs., 2 figs.

3305 **(MLM—3548(OP)) A study of the statistical distribution of airborne particles in Class 100, 1000, 10,000 and 25,000 cleanrooms and clean areas.** Mielke, R.L.; Shaughnessy, G.J. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 1988. Contract AC04-76DP00053. 12p. (CONF-880933—3). NTIS, PC A03/MF A01. Order Number DE89001484/JAW.

From 9. annual international symposium on contamination control; Los Angeles, CA, USA (26 Sep 1988).

Counts were made of the number of particles larger than 0.5 μm in Class 100, 1000, 10,000, and 25,000 cleanrooms. For each class of room, the frequency distribution of the recorded number of counts is summarized by a graph showing the results of the data collected. The frequency distribution of the actual count data was then compared to the predicted frequency distribution obtain by fitting various statistical models to the data. Three statistical models were used for the frequency distribution of the count data: the normal distribution, the Poisson with zeros distribution, and the negative binomial distribution. Finally, the statistical requirements for the verification of a cleanroom as specified in Federal Standard 209C were applied to one run of count data from each cleanroom or zone. 5 refs., 22 figs., 7 tabs.

3306 **(N—88-27507) Temperature rise in superfluid helium pumps.** Kittel, P. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Jul 1988. 8p. (NASA-TM—100997; A—88172; NAS—1.15:100997). NTIS, PC A02/MF A01.

The temperature rise of a fountain effect pump (FEP) and of a centrifugal pump (CP) are compared. Calculations and estimates

presented here show that under the operating conditions expected during the resupply of superfluid helium in space, a centrifugal pump will produce a smaller temperature rise than will a fountain effect pump. The temperature rise for the FEP is calculated assuming an ideal pump, while the temperature rise of the CP is estimated from the measured performance of a prototype pump. As a result of this smaller temperature rise and of the different operating characteristics of the two types of pumps, transfers will be more effective using a centrifugal pump.

3307 **(SAND—88-2745) Development of a mobile gas gun.** Lundgren, R.G.; Hightower, M.M.; Christensen, B.K. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-8810183—3). NTIS, PC A02/MF A01. Order Number DE89001364/JAW.

From 39. Aeroballistics Range Association meeting; Albuquerque, NM, USA (10 Oct 1988).

Sandia National Laboratories Division 9122 is completing construction of a portable, 6" bore, high performance, single stage compressed gas (air/helium) gun. The gun was developed to accommodate direct penetration tests into geologic media at a variety of impact and incidence angles freeing users of reverse ballistic and/or target simulation methods. It is designed to propel projectiles (5 lbs.) up to 2500 ft/sec. Initial operation and performance evaluation began in August 1988. The gun will be fully operational in October 1988. The gas gun is mounted on a 50' by 8' trailer. In addition, all ancillary equipment, compressor, electrical generator, two 25 cubic foot storage tanks and one 7 cubic foot power chamber tank, valves, and pressure control are mounted on the trailer. The trailer is tethered to an IBM PC with a 4 conductor cable to accommodate remote firing. Several test series have already been scheduled for this gun in FY89. These include a lateral loading benchmarking study with 10 lb. projectiles instrumented with 6 channels of acceleration and strain data, a controlled depth of burial study for 40 lb. runway penetrators, and a scale model study of multilayered target penetration. The last two series are being done under the Joint DOD/DOE Munitions Technology Development Program. In this paper we will discuss the design, development and operational capability of this new mobile gas gun. 2 refs., 3 figs.

3308 **(SAND—88-2847C) An uncertainty analysis for the Structural Mechanics Laboratory.** Crabb, R.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-881174—3). NTIS, PC A02/MF A01. Order Number DE89001816/JAW.

From Experimental mechanics in manufacturing and quality control; Indianapolis, IN, USA (6 Nov 1988).

An investigation of the uncertainties associated with instrumentation used in a structural mechanics laboratory is outlined in this report. Results from studies made to quantify measurement data and various uncertainty factors related to randomness, load cells, linear variable differential transformers (LVDTs) and data collection devices show that the overall uncertainty is of the order of one or two percent. The subject of measurement traceability is discussed followed by a description of the system, analysis, and conclusions. 4 refs., 1 tab.

3309 **(UCRL—99681) Shock propagation in meshes with large aspect ratio cells.** Margolin, L.G. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1988. Contract W-7405-ENG-48. 10p. (CONF-881093—8). NTIS, PC A03/MF A01. Order Number DE89002657/JAW.

From Nuclear explosives code developer's conference; Boulder, CO, USA (11 Oct 1988).

The cell-centered formulation of artificial viscosity has many advantages for simulating fluid flows with strong shocks. This formulation does have problems when the computational cells have large aspect radio. The problems are associated with the choice of the viscous coefficient and in particular with finding an appropriate length scale for the flow. I will describe a new formulation of the artificial viscosity that preserves the advantages of the cell-centered schemes, and also works well for long thin cells. I will discuss the use of a nonsymmetric viscous stress tensor and show that it yields superior results when applied with appropriate boundary conditions. These results are summarized from a more formal report (UCRL--53882), which contains the detailed mathematical analysis of these results. 6 refs., 4 figs.

3310 **(WHC-SA—0404) An automated method for determining the areas covered by gamma sensitive criticality detectors.** Rittmann, P.D. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 7p. (CONF-8809144—3). NTIS, PC A02/MF A01. Order Number DE89001915/JAW.

From DOE criticality alarm system workshop; Richland, WA, USA (20 Sep 1988).

A description of the computer program LOCAS is given. LOCAS was developed at the Hanford site to assist in evaluating what areas in a facility are covered by the gamma-sensitive criticality detectors for various alarm trip settings. Detectors may be grouped into "2 of n" sets, and there may be multiple sets. Representations of facility walls are stored in a wall library file, and detector coordinates may also be stored in a library file. Program output consists of numerical tables of dose rates and/or printhead graphics with print characters representing dose rates in a user-defined search plane. The primary limitations of the code are: the assumed photon spectrum is that of prompt gammas from fission, without including the effect of neutron interactions, which tend to produce higher energy photons, and limited inclusion of photon scattering through the use of dose buildup factors. For the purpose of evaluating the areas covered by a detector set, these limitations are conservative, i.e., they tend to underestimate the areas covered by the detection system. 5 refs., 2 figs., 1 tab.

4203 Lasers

REFER ALSO TO CITATION(S) 3165, 3352, 3372, 3994, 4015

3311 **(AD-A—196334/7/XAB) Cherenkov free-electron laser.** Walsh, J.; Shaughnessy, C.; Layman, R.; Dattoli, G.; Gallerano, G. (Dartmouth Coll., Hanover, NH (USA)). 1987. 4p. NTIS, PC A02/MF A01.

Pub. in Proceedings or the International Electron Devices Meeting, 300-302(1987).

Cherenkov radiation, produced by mild to moderately relativistic electron beams as they traverse dielectric-loaded surface-wave resonators, can be used as the basis of a free-electron laser. Devices of this kind have now been operated at wavelengths ranging from the cm to the far-infrared region of the spectrum. Recent work is summarized. Three different accelerator types and a range of operating voltages have been employed. Pulse-line accelerators (PLA) and pulse transformers (PT) have been used in the mm-sub mm regime. At shorter wavelengths, compact radio-frequency accelerators can be employed. This summary reviews a 5 M&V microtron accelerator-driven experiment. The electron beam consists of a train of 25-ps-long micropulses spaced at the period of the 3-Ghz accelerating field and the resonator consists of a pair of opposing trough guides. One of the trough surfaces is coated with a thin polyethylene film. The film thickness, together with the beam energy determine the operating wavelength. In the present experiment, a 2-micrometer film and the 5-MeV beam give a design wavelength of 100 micrometers.

3312 **(AD-A—196505/2/XAB) Topical meeting on lasers in material diagnostics held in Albuquerque, New Mexico on 11-12 February 1987. Technical Digest series. Volume 7. Final report, 1 January-31 October 1987.** Quinn, J.W. (Optical Society of America, Washington, DC). 31 Oct 1987. 141p. NTIS, PC A07/MF A01.

Semiconductor-diode lasers remain the subject of intensive worldwide development efforts with rapid progress being made in many areas of device design and performance. In addition to their use in optical-fiber systems, other applications have been identified and lasers are being fabricated to meet many different system requirements. This meeting treated all aspects of laser design, development, and characterization. Laser and optical techniques are increasingly important for diagnostics of a wide variety of materials and processing technologies. Applications range from diagnostics of impurities and other defects in materials, to probes of dry-processing technologies for semiconductor-device fabrication, to imaging

techniques for patterning and analysis in VLSI manufacture. These techniques are being used both for analytic measurements and as tools to probe new materials and effects. This meeting brought together workers from all of these areas for the exchange of results and of new directions for research.

3313 **(AD-A—196553/2/XAB) Summaries of papers presented at the semiconductor lasers topical meeting held in Albuquerque, New Mexico on February 10-11, 1987. Final report, 1 January-31 October 1987.** Quinn, J.W. (Optical Society of America, Washington, DC). 31 Oct 1987. 192p. NTIS, PC A09/MF A01.

Semiconductor diode lasers remain the subject of intensive worldwide development efforts with rapid progress being made in many areas of device design and performance. In addition to their use in optical-fiber systems, other applications have been identified. This meeting treated all aspects of laser design, development, and characterization. Laser and optical techniques are increasingly important for diagnostics of a wide variety of materials and processing technologies. Applications range from diagnostics of impurities and other defects in materials, to probes of dry-processing technologies for semiconductor device fabrication, to imaging techniques for patterning and analysis in VLSI manufacture. These techniques are being used both for analytic measurements and as tools to probe new materials and effects. This meeting brought together workers from all of these areas for the exchange of results and of new directions for research. Optical materials are being applied in ever-more-stressing environmental conditions. The response and durability of optical materials and coatings under the challenges posed by these environments can determine the overall success of many large-scale programs and of whole classes of optical devices. The purpose of this meeting is to bring together researchers with experience in all aspects (materials, design, fabrication, testing and performance) of optics in highly adverse environments for an exchange of results, techniques and discussion of future research directions.

3314 **(AD-A—196851/0/XAB) Effect of thermal cycling. Final report, April 1985-January 1987.** Jacobs, S.F. (Arizona Univ., Tucson (USA). Optical Sciences Center). May 1988. 49p. NTIS, PC A03/MF A01.

The objective of this effort is to evaluate the stability of low expansion Zerodur, developmental Zerodur, ULE, and Cer-Vit as possible substrate materials for high energy laser mirrors. This effort will determine whether there is instability in developmental Zerodur, ULE and Cer-Vit over operating temperatures and coating temperatures (300-475K). Zerodur has already been shown to exhibit instability. Thermal cycling will be investigated as a possible approach to eliminate or reduce hysteresis. The effect of polishing on hysteresis will also be investigated.

3315 **(AD-A—196910/4/XAB) Amplitude-stabilized chaotic light.** Radzewicz, C.; Li, Z.W.; Raymer, M.G. (Rochester Univ., NY (USA). Inst. of Optics). 15 Mar 1988. 10p. NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 37, No. 6, 2039-2047(15 Mar 1988).

Large-bandwidth laser light pulses with pure frequency fluctuations were generated. Chaotic-light pulses from a cavityless dye laser are temporally smoothed by passing them through strongly saturated amplifiers. Since the amplification process does not change the phase of the amplified light, the output radiation has the well-defined phase fluctuations of chaotic light, yet essentially no amplitude fluctuations.

3316 **(AD-A—196928/6/XAB) Analysis of free-electron laser performance utilizing the National Bureau of Standards' c-w microtron. Interim report.** Tang, C.M.; Sprangle, P.; Penner, S.; Maruyama, X.K. (National Bureau of Standards, Washington, DC (USA)). 19 May 1988. 37p. NTIS, PC A03/MF A01.

The c-w racetrack microtron (RTM) will be utilized as a driver for a free electron laser (FEL) oscillator. The TRM possesses many exceptional properties of value for the FEL: i) c-w operation, ii) energy from 20-185 MeV, iii) small energy spread and emittance, iv) excellent energy stability, and v) high average power. The 1-D FEL gain formula predicts that the FEL would oscillate at the fundamental approximately from 0.25 to 10 micrometers when up-grading the peak current to $>$ or $=$ 2A. This paper presents 3-D self-consistent numerical results including several realistic effects, such as emittance, betatron oscillations, diffraction, and refraction. The results indicate that the design value of the transverse emittance is small enough that it does not degrade the FEL performance for intermediate to long wavelengths, and only slightly degrades the performance at the shortest wavelength under consideration. Due to the good emittance, the current density is high enough that focusing, or guiding, beings to manifest itself for wavelengths $>$ 2.0 micrometers.

3317 **(AD-A—196972/4/XAB) Bibliography of Soviet laser developments, Number 81, January-February 1986.** (Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence). 24 Apr 1987. 126p. (DIA-DST—2700Z-005-87). NTIS, PC A07/MF A01.

This Soviet Laser Bibliography is no. 81 in a continuing series on Soviet laser developments. The coverage includes basic research on solid-state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort-pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications systems; beam propagation; adaptive optics; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser-measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics.

3318 **(AD-A—196973/2/XAB) Bibliography of Soviet laser developments, Number 87, January-February 1987.** (Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence). 29 Dec 1987. 145p. (DIA-DST—2700Z-001-88). NTIS, PC A07/MF A01.

This Soviet Laser Bibliography is no. 87 in a continuing series on Soviet laser developments. The coverage includes basic research on solid-state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications systems; beam propagation; adaptive optics; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser-measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics.

3319 **(LA-SUB—D8426C-3) Cloud clearing technology assessment: Final report.** (Los Alamos National Lab., NM (USA); Schafer (W.J.) Associates, Inc., Chelmsford, MA (USA)). Mar 1988. Contract W-7405-ENG-36. 81p. (WJSA-R—88-013). NTIS, PC A05. Order Number DE89001981/JAW.

This report describes work done by W.J. Schafer Associates (WJSA) in support of the Long Pulse Chemical Laser (LPCL) project at the Los Alamos National Laboratory (LANL) in 1986-1987. The present document emphasizes work in the area of cloud hole boring. It consists of the Final Task reports for Tasks II (Meteorological Statistics), III (Cloud Clearing Concept Development) and IV (Fluid Mechanics). A separate report on ASAT analyses has been prepared and was delivered to the LANL program manager in April 1988. (This document contained results from several WJSA IRAD projects which are considered proprietary, hence they are not included in this Final Report Volume.) A third document describing work on laser kinetics analyses (Task I) will be provided separately. The present document is the Final Report for this subcontract. It describes work in the areas of cloud clearing mission analysis, cloud clearing experiment recommendations, and meteorological statistics relevant to cloud clearing and laser weapon propagation. 20 refs., 29 figs., 7 tabs.

3320 **(LA-UR—88-3426) Projected performance of rf-linac-driven free-electron lasers in the extreme-ultraviolet spectral region.** Newman, B.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-881151—21). NTIS, PC A03/MF A01. Order Number DE89002128/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

A free-electron laser user facility for scientific experimentation in the vacuum-ultraviolet and soft x-ray spectral regions (together termed the XUV) is being developed at Los Alamos. The design includes a series of laser oscillators and amplifiers, driven by a single, rf-linear accelerator, that will generate broadly tunable, picosecond-pulse, coherent radiation from 1 to 400 nm. Below 300 nm, the peak- and average-power output of these FEL devices should surpass the capabilities of any existing, continuously tunable photon sources by many orders of magnitude. The design and output parameters of this facility will be described, including comparison with synchrotron radiation sources, and recent progress in developing the three primary components (electron beam, magnetic undulator, and resonator mirrors) will be reviewed. 23 refs., 2 figs., 2 tabs.

3321 **(LA-UR—88-3546) Integrated numerical modeling of free-electron laser oscillators.** Goldstein, J.C.; McVey, B.D.; Carlsten, B.E.; Thode, L.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-8808146—5). NTIS, PC A03/MF A01. Order Number DE89002351/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

The nonideal characteristics of the electron beam have largely determined the performance of all free-electron laser (FEL) oscillators that have operated up to the present time. A realistic quantitative theoretical assessment of FEL oscillator performance must therefore include a viable representation of the electron beam's characteristics, as well as the properties of the wiggler magnet and the optical resonator. This paper presents results of integrated numerical modeling of the Los Alamos FEL oscillator, using as input to the 3-d FEL simulation code FELEX, a numerically-generated electron pulse obtained from the accelerator code PARAMELA as a solution of a full mode of the Los Alamos accelerator system (electron gun, accelerator cavities, and beam transport line). 19 refs., 7 figs., 3 tabs.

3322 **(N—88-27553) Overview and future direction for blackbody solar-pumped lasers.** Deyoung, R.J. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Aug 1988. 23p. (NASA-TM—100621; NAS—1.15:100621). NTIS, PC A03/MF A01.

A review of solar-pumped blackbody lasers is given which addresses their present status and suggests future research directions. The blackbody laser concept is one system proposed to scale to multimegawatt power levels for space-to-space power transmissions for such applications as onboard spacecraft electrical or propulsion needs. Among the critical technical issues are the scalability to high powers and the laser wavelength which impacts the transmission optics size as well as the laser-to-electric converter at the receiver. Because present blackbody solar-pumped lasers will have laser wavelengths longer than 4 microns, simple photovoltaic converters cannot be used, and transmission optics will be large. Thus, future blackbody laser systems should emphasize near visible laser wavelengths.

3323 **(PB—88-869367/XAB) Excimer lasers: applied research and commercial development. January 1980-September 1988 (Citations from the Searchable Physics Information Notices data base). Report for January 1980-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 100p. NTIS PC N01/MF N01.

Supersedes PB—87-867313.

This bibliography contains citations concerning research, development, testing, stability, and reliability of both XeCl and XeF excimer lasers. Excimer-laser utilization for vapor-deposited coating processes, cardiovascular surgery, and microelectronics fabrication are presented. Laser etching of polymers, diamonds, and hard-carbon films are discussed. Construction of very large excimer-laser amplifiers and comparative analysis of wide-band excimer lasers with optically or electron-beam pumping are examined. (This updated bibliography contains 225 citations, 20 of which are new entries to the previous edition.)

3324 **(PB—88-869482/XAB) Neodymium YAG (yttrium aluminum garnet) lasers. January 1970-September 1988 (Citations from the NTIS data base). Report for January 1970-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 170p. NTIS PC N01/MF N01.

Supersedes PB—687-863817.

This bibliography contains citations concerning design, fabrication, and testing of neodymium-doped yttrium aluminum garnet lasers. Included are citations covering such areas as quantum efficiency, stabilization, mode locking, frequency conversion, and modulation. Some laser applications are included, especially if the citation covers design confirmation or comparison with other types of lasers. Some of these applications are optical communications, range finding, and tracking. Safety hazards and radiation damage are also referenced in a few citations. (This updated bibliography contains 288 citations, 33 of which are new entries to the previous edition.)

3325 **(UCRL—15867-Vol.3) New laser materials: Final report.** (Lawrence Livermore National Lab., CA (USA); Allied-Signal, Inc., Morristown, NJ (USA)). May 1988. Contract W-7405-ENG-48. 31p. NTIS, PC A03/MF A01. Order Number DE89002651/JAW.

In this report we summarize our research activities at Allied-Signal, Inc. during the 1987 contract period. Our main objectives are: search for ICF reactor laser (Nd-doped compounds), and search for pump laser for 10 MJ research laser (Cr-doped compounds). In the process of searching for new materials suitable for these purposes, we occasionally might also encounter interesting new laser hosts which may not necessarily fit our primary objectives, but nevertheless may have properties useful in other applications. This report includes three main subject areas, the metaphosphates, LGS ($La_3Ga_5SiO_{14}$) and $ScAlBeO_4$. We will also discuss briefly the direction of future research and the prospect of finding the right material. 7 refs., 9 figs.

3326 **(UCRL—98113) Beta-barium borate as an electro-optic material for high power lasers.** Ebbers, C.A. (Lawrence Livermore National Lab., CA (USA)). 11 Aug 1988. Contract W-7405-ENG-48. 9p. (CONF-880887—22). NTIS, PC A02/MF A01. Order Number DE89001291/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

The potential of Beta-Barium Borate (β-BaB_2O_4) for use as an EO material is evaluated. The magnitude of the EO coefficient is due mainly to the electronic nonlinearity. The expected half-wave voltages and thermo-mechanical parameters of β-BaB_2O_4 plates in various configurations are calculated and compared with those of other materials of interest. Its resistance to thermal fracture, high damage threshold, and its wide range of transparency, make β-BaB_2O_4 an excellent candidate for use in a high average power Pockels cell, and as an intra-cavity laser Q-switch. 5 refs., 3 tabs.

3327 **(UCRL—99661) Compact x-ray lasers in the laboratory.** Barletta, W.A. (Lawrence Livermore National Lab., CA (USA)). 3 Oct 1988. Contract W-7405-ENG-48. 15p. (CONF-8808101—2). NTIS, PC A03/MF A01. Order Number DE89001132/JAW.

From International seminar on nuclear war; Erice, Italy (19 Aug 1988).

Compact x-ray lasers in the laboratory can be produced with ultrahigh gradient rf linacs based on recent advances in linac technology by an SLAC-LLNL-LBL collaboration and on the development of bright, high current electron sources by BNL and LANL. The GeV electron beams generated with such accelerators can be converted to soft x rays in the range of 2--10 nm by passage through short period, high field strength wigglers. Alternatively,

the beam can pump a low density dielectric to produce x rays via recombination. Such linear light sources can produce trains of picosecond (or shorter) pulses of extremely high spectral brilliance suitable for flash holography of biological specimens in vivo and for studies of fast chemical reactions. 15 refs., 7 figs., 3 tabs.

3328 **Rate coefficients for populating excited levels of Ni-like ions by inner-shell ionization of Cu-like ions.** Sampson, D.H.; Zhang, H.L.; Mohanty, A.K. (Department of Astronomy, The Pennsylvania State University, University Park, Pennsylvania 16802). *Physical Review [Section] A: General Physics;* **38**: No. 9, 4569-4573(1 Nov 1988).

Simple expressions that include configuration and intermediate coupling mixing effects are given for the cross sections and rate coefficients for populating the n = 4 excited levels of nickel-like ions by the process of inner-shell ionization of copperlike ions. Some illustrative numerical results for the rate coefficients are given for gadolinium (Z = 64) and compared with the relativistic distorted-wave rate coefficients of Hagelstein [Phys. Rev. A 34, 874 (1986)] for populating the same excited level of Ni-like gadolinium by the alternative process of excitation from the ground level.

3329 **(AD-A—196860/1/XAB) Vibrational relaxation processes in a CO_2-N_2-H_2O laser system.** Yan, H. (Air Force Systems Command, Wright-Patterson AFB, OH (USA). Foreign Technology Div.). 13 Jul 1988. Trans. of Jiguang (China) v8 n6 p1-8, 1981. (FTD-ID(RS)T—0257-88). 21p. NTIS, PC A03/MF A01.

Vibrational relaxation processes and data of a carbon dioxide-nitrogen-water laser system up to the present are surveyed. The data before 1988 are based on Taylor & Bitterman's review. The data are treated with weighted least-square methods to get the best fit in the form of log10K = A + BX + CX2 + DX3 and the corresponding coefficients are presented. Using these best fits of data and relaxation model with three modes and four vibrational temperatures based on the present work, numerical calculation results of small signal gain of GDL agree with experiments, thus eliminating the error introduced by the uncertainties of relaxation data and model.

3330 **(AD-A—196861/9/XAB) Basic rules of saturated gain variation in a flowing laser cavity.** Wu, Z.; Yan, H. (Air Force Systems Command, Wright-Patterson AFB, OH (USA). Foreign Technology Div.). 8 Jul 1988. Trans. of Jiguang (China) v7 n3 p5-8 1980. (FTD-ID(RS)T—0260-88). 13p. NTIS, PC A03/MF A01.

From numerical calculation, the basic rules of saturated gain coefficient variation with the field distribution along the flow direction in a Gas Dynamic Laser (GDL) cavity are presented. In connection with variations of vibrational energy and temperature of all modes, these rules are explained with the physical mechanism of relaxation of the active medium. It is pointed out that, for example, there still exists considerable vibrational energy that can be used for Gerry's device with 30-kW monomode output.

3331 **(AD-A—196660/5/XAB) Two-dimensional saturation gain and output power in transverse-flow electrical-discharge CO_2 lasers.** Chen, L.; Chu, Z.; Wu, Z. (Air Force Systems Command, Wright-Patterson AFB, OH (USA). Foreign Technology Div.). 24 Jun 1988. Trans. of Guangxue Xuebao (China), Vol. 5, No. 2, 135-141(Feb 1985). (FTD-ID(RS)T—0262-88). 20p. NTIS, PC A03/MF A01.

This article presents the two-dimensional distribution of saturation-gain parameters in traverse-flow-discharge carbon dioxide lasers as well as the laws for their changes along with changes in radiation fields. Use was made of microscopic physical mechanisms to make notes and explanations. Three types of stability oscillation conditions were used to respectively calculate the light-strength distributions within cavities and output powers. Moreover, this provides a comparison for discussion and offers a type of simple and convenient method for selecting the device with the best design plan.

4204 Heat Transfer And Fluid Flow

3332 **(AD-A—196777/7/XAB) Computational fluid dynamics: algorithms and supercomputers.** Gentzsch, W.; Neves, K.W.; Yoshihara, H. (Advisory Group for Aerospace Research and Development, 92 - Neuilly-sur-Seine (France)). Mar 1988. 196p. (AGARD-AG—311). NTIS, PC A09/MF A01.

Cost-effective vectorization of fluid-dynamic codes, in particular the Navier/Stokes Code, is covered relative to the supercomputer architecture. Subjects include current supercomputer architecture; minisupercomputers; impact of hardware on computing; software migration issues; benchmarking; guidelines on Fortran vectorization at the do-loop level; restructuring of basic linear algebra algorithms; and restructuring guidelines for basic fluid-dynamic codes. A glossary of supercomputing terms is given in the Appendix.

3333 **(CONF-881115—5) Decay heat transfer via natural convection during a postulated severe accident.** Domanus, H.M.; Sha, W.T. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE89000662/JAW.

From 3. international topical meeting on nuclear power plant thermal hydraulics and operations; Seoul, Korea (14 Nov 1988).

A numerical simulation of the multidimensional thermal-hydraulic characteristics in a three-loop PWR during a hypothetical TMLB' accident has been performed by means of the COMMIX computer code. The operating conditions, as well as the modeling approaches used in the simulation, are discussed. Selected results, which show the natural circulation and compare the thermal-hydraulic behavior in the different loops, are presented. The calculated results are in good agreement qualitatively with the out of pile experimental measurements. 9 refs., 7 figs., 1 tab.

3334 **(DOE/CE/40716—2-Vol.2) Assessment of high pressure heat exchange systems technology: Volume 2, Appendices.** (Mueller Associates, Inc., Baltimore, MD (USA)). Oct 1987. Contract AC01-84CE40716. 197p. NTIS, PC A09/MF A01. Order Number DE88012503/JAW.

The industrial applications considered under the HiPHES program span a wide range of operating conditions and materials requirements. The materials of construction for these applications will be subjected to high temperatures and pressures in the presence of a variety of corrosive agents. Design requirements dictate that these materials maintain their high strength and structural integrity over relatively long periods in order to provide the basis for efficiency improvements. An overview and assessment of traditional and novel materials designed for or deemed capable of the best performance under severe service conditions is provided. Generic materials categories included in this review are the metals (alloys and superalloys), monolithic ceramics, and composites.

3335 **(FEI—1879) Model of impurity deposition in steam-generating tubes.** Muranov, Yu.V.; Kashcheev, V.M.; Yur'ev, Yu.S.; Anisimov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704684/JAW.

A mathematical model for determining the quantity of impurity, deposited on the wall and removed together with droplets, steam and in the form of aerosols in a vertically heated tube under dispersion-ring and dispersion steam-water mixture flow regimes, is presented. Heat-exchange, mass-exchange and hydrodynamical problems in a two-dimensional statement are considered. An equation system is written down in a dimensional form with implicit source term presentation. Boundary conditions, admissions necessary for the model realization in the form of computer calculation program are formulated. 8 refs.; 2 figs.

4205 Materials Testing

REFER ALSO TO CITATION(S) 3076, 3126, 3312, 3313

3336 (CONF-870762—, pp IV.33-IV.48) **Comprehensive review of wear testing.** Kelley, J.E.; Stiglich, J.J. (Wear Technology, Inc., Gaston, OR (USA)). 1987. NTIS, PC A19/MF A01. Order Number DE88016198/JAW.

From Coatings for advanced heat engines workshop; Castine, ME, USA (27 Jul 1987).

The wear testing of coatings, surface modifications, and hardfacing materials presents a number of problems that can lead to an inaccurate assessment of their wear behavior. A discussion of several wear testing problems is given, along with pertinent examples and some techniques for preventing or minimizing the problems. Hundreds of wear tests have been devised for evaluating the wear characteristics of every class of material. A few test methods that have been successfully applied to coatings and surface modifications, some standardized and some not, are presented. 14 references, 19 figures.

3337 (DOE/ER/13641—1) **Thinning and rupture of a thin liquid film on a horizontal heated solid surface: Progress report for period June 16, 1987--July 31, 1988.** Bankoff, S.G.; Davis, S.H. (Northwestern Univ., Evanston, IL (USA)). Aug 1988. Contract FG02-86ER13641. 10p. NTIS, PC A02. Order Number DE89001792/JAW.

The analysis of the nonlinear stability and rupture of a thin liquid film on a heated horizontal plate has been completed. Extensions to condensing films, films subjected to constant heat fluxes and films with three-dimensional waves have been obtained. Multiple time scales were introduced in order to determine the effects of the initial conditions, and to clarify the behavior just before rupture. The general evolution equation has been derived for the case where both the viscosity and the surface tension are linear functions of temperature. The thinning and rupture of a thin film of an organic liquid on a non-uniformly heated Invar plate has been measured. Analysis of the data is in progress. 5 refs., 4 figs.

3338 (IC—87/203) **On the theoretical aspects of AE-graphy.** Braginsky, A.P.; Efimenko, S.P.; Kurbatov, A.M.; Zdan'sky, A.K. (Gosudarstvennyj Komitet Soveta Ministrov SSSR po Nauke i Tekhnike, Moscow; International Centre for Theoretical Physics, Trieste (Italy); AN SSSR, Moscow (USSR). Computer Centre). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704689/JAW.

The mathematical model of the acoustic emission generated by the different types of collective motions of imperfections is considered. The time dependence of the emitting intensity and the dependence of the characteristic spectrum on the typical imperfection degree of correlation is studied. The possibilities of the applications of the present approach to the identification of the imperfections and to the prediction of their development are discussed. (author). 3 ref., 2 figs.

3339 (NIIAR—2(713)) **Technique for processing the results of determination of dielectric strength of electrical insulation compositions under in-pile conditions for small samples.** Neverov, V.A.; Revyakin, Yu.L. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1987. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704884/JAW.

A mathematical model, allowing one to evaluate the results of investigations into dielectric strength of insulation compositions for nuclear power plant electromagnetic pumps under their thermoradiational ageing in a reactor test channel is described. Minimal test sizes, needed to obtain the acceptable result errors under the comparison of different insulation compositions are specified to choose the most promising one. Methods for evaluating dielectric strength of the given compositions under small samples with the assigned probability of reliable operation and result reliability are presented. In this case correlation analysis of arbitrary value linearized distribution is used as the method for selecting theoretical distribution which best of all agrees with the experimental data obtained. 13 refs.; 1 fig.; 9 tabs.

3340 (UCRL—53868-87, pp 7.18-7.22) **High-temperature metal-alloy radiant-property measurements in conjunction with advanced surface spectroscopy.** Havstad, M.A.; McLean, W. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The purpose of this work is to study the radiative and optical properties of pure metal surfaces using both a state-of-the-art radiation property measurement system and the recently developed techniques of surface analysis. These techniques, Auger electron spectroscopy and argon ion bombardment, allow one to analyze in detail the atomic composition of pure metallic surfaces. In not other reported research have these tools been used, so sample materials have been impure and of unknown composition. In FY 87 the authors used their apparatus to study the radiative properties and/or optical constants of pure uranium and liquid indium, of high-temperature ceramics, and of other materials. They found that the emissivity of uranium depended strongly on wavelength. From data on molten indium, they have derived its complex index of refraction as a function of wavelength. This achievement represents the starting point for the theoretical work on the optical and electronic properties of pure metal surfaces.

3341 (UCRL—53868-87, pp 7.23-7.28) **Numerical modeling of crack growth and plastic deformation.** Riddle, R.A. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The author has developed analytical tools and material test methods to predict failure in structural components caused by crack growth and plastic deformation. As part of the effort to characterize the elastic-plastic deformation at a crack tip, he updated the existing J Integral postprocessor for the two-dimensional finite-element code NIKE to calculate the effects of thermal strains. Results from two thermal stress problems indicate the usefulness of this new tool for predicting crack growth. The author performed fracture toughness tests on depleted uranium (D38) to determine the relationship between the material's microstructure and chemistry and its fracture toughness as a function of temperature. The size and distribution of uranium carbide precipitates strongly influenced the temperature fracture transition behavior of the uranium. He performed fracture toughness and notched strength bend tests on HY130 steel. The greater amount of plastic deformation allowed by the notch when compared with the crack increased the load to failure in the three-point bend HY130 specimens.

3342 (UCRL—53868-87, pp 7.29-7.31) **Strength of composite materials.** Groves, S.E.; Feng, W.W.; Brentjes, J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors are improving their ability to predict accurately the strength of composite materials, experimentally and theoretically. The primary goals were to review the existing failure criteria, to develop a new failure criterion, and to design a biaxial test apparatus to generate failure surfaces for composites. They directed their major effort to developing the biaxial test apparatus, including designing and fabricating tension-torsion-internal pressurization grips and a biaxial extensometer for simultaneous measurement of axial and torsional displacements. Although they did not test the apparatus in FY 87, they are now ready to generate the necessary surfaces for evaluating failure criteria. They have reviewed several existing failure criteria and proposed a new criterion written in terms of the Cauchy finite-strain invariants for a transversely isotropic medium. They have successfully applied this new criterion to predict the failure of a mechanical part. In FY 88, the authors will continue the work using the available experimental and theoretical tools to evaluate the new failure criterion.

3343 (UCRL—53868-87, pp 7.32-7.36) **High-strain-rate tensile testing.** Lassila, D.H.; Scott, R.G. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

New analysis techniques have been developed for the tensile Hopkinson bar test to determine stress-vs-strain behavior of materials at high strain rates. The new techniques center on the use of high-elongation post-yield strain gauges to measure dynamic strain. High-speed digitizers are used to record transient strain-gauge signals of about 200-μs duration to obtain stress-vs-time and strain-vs-time histories, which are then phased together to produce a stress-vs-strain record. Tests performed on 316 stainless steel demonstrate the utility of the analysis techniques and indicate that the tensile Hopkinson bar results are consistent with compression Hopkinson bar results.

3344 (UCRL—53868-87, pp 9.1-9.13) **Research in quantitative ultrasonic nondestructive evaluation.** Clark, G.A.; Lewis, D.K. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The objective is to use a combination of laboratory experiments, physical modeling, and signal processing to improve the ability to measure the physical properties of materials. In FY 87 the authors continued to improve techniques for interpreting signals acquired from the ultrasonic test bed and the acoustic microscope. They made progress in several areas of research. Specifically, the authors studied and applied model-based estimation algorithms for layered materials. They successfully applied signal- and image-restoration algorithms to signals from measurements taken on materials used in several Laboratory applications. The pulse-preshaping work led to new transducer modeling techniques and laboratory apparatus for avoiding signal distortion caused by transducers and instrumentation. They developed hardware and software for rapid implementation of the sophisticated deconvolution and restoration algorithms they developed in FY 85 and FY 86. FY 87 marks the third and final year of the three-year project. For FY 88 the authors propose related work to finish the lossy layered medium modeling they began in FY 87, which would constitute an important tool for use in solving some of the most difficult nondestructive evaluation problems. 43 references.

3345 (UCRL—53868-87, pp 9.14-9.19) **Research in computed tomography.** Brase, J.M.; Waltjen, K.E.; Martz, H.E. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have researched the use of computed tomography (CT) imaging for evaluating materials of interest at LLNL. They have demonstrated a microfocus CT system aimed at high-resolution applications, as well as a pencil-beam CT system for quantitative material evaluation. Given a model of the x-ray imaging system, they have developed algorithms for enhancing the resolution of images. A new reconstruction algorithm has been developed that can easily incorporate a priori knowledge of the specimen being imaged. The authors have used reconstruction programs on several systems to compare their performance and have begun to develop an algorithm for the SPRINT architecture. They expect that the research begun in FY 87 will lead to a major research and development project in FY 88 to provide a comprehensive CT capability at the Laboratory.

3346 (UCRL—53868-87, pp 9.20-9.23) **Scanning tunneling microscopy as a detector.** Day, R.A.; Siekhaus, W.J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have investigated the potential of scanning tunneling microscopy (STM) and atomic force microscopy (AFM) for surface figure measurement of optical components. These methods can provide higher-resolution surface topology measurements than can conventional surface profilometers and can do so at very high speeds. The primary research goal was to determine the potential of STM for detecting defects (believed to cause damage to high-power optical components) on polished optical surfaces. The authors have begun to design and develop instruments to image both nonconducting and conducting surfaces with resolutions of 1 to 2 A. The secondary objective was to investigate the application of STM and AFM technology to acoustic defect detection.

3347 (UCRL—53868-87, pp 10.1-10.11) **Digital imaging.** Fitch, J.P. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

In FY 87, the author extended current image-processing capabilities and contributed significantly to the field of digital imaging. He proposed research that included investigations of new image-processing algorithms related to various programmatic problems and theoretical studies in areas of considerable interest and potential long-term benefit to the Laboratory. Specifically, he found a new approach to diffraction tomography that uses a priori information about parts being inspected to reconstruct images from incomplete measurements, investigated a novel software architecture that he applied to image processing and will extend to multidimensional uses in FY 88, and developed a method of synthetic aperture focusing for ultrasound that enhances the nondestructive inspection capabilities.

3348 (UCRL—53868-87, pp 10.27-10.28) **Transient wave interaction with a multiple-layered slab.** Dudley, D.G. (Univ. of Arizona, Tucson (USA)). Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The author has created an interactive Vax VMS algorithm that provides electromagnetic reflection and transmission data from a multiple-layered slab. During FY 87, he completed and tested the algorithm, and LLNL workers used it for nondestructive testing and evaluation. For the no-loss case, results from the algorithm have compared favorably with results from a lattice filter algorithm presently used at LLNL.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 2914, 2986, 3215, 3220, 3225, 3238, 3302, 3312, 3313, 3416, 3475, 4056

3349 **(AD-A—196339/6/XAB) Influence of ion-implanted profiles on the performance of GaAs MESFET's and MMIC amplifiers.** Pavlidis, D.; Cazaux, J.L.; Graffeuil, J. (Michigan Univ., Ann Arbor (USA). Dept. of Electrical Engineering and Computer Science). Apr 1988. 13p. NTIS, PC A03/MF A01.

Pub. in IEEE Transactions on Microwave Theory and Techniques, Vol. 36, No. 4, 642-652(Apr 1988).

The RF small-signal performance of GaAs MESFET's and MMIC amplifiers as a function of various ion-implanted profiles is theoretically and experimentally investigated. Implantation energy, dose, and recess depth influence are theoretically analyzed with the help of a specially developed device simulator. The performance of MMIC amplifiers processed with various energies, doses, recess depths, and bias conditions is discussed and compared to experimental characteristics. Some criteria are finally proposed for the choice of implantation conditions and process in order to optimize the characteristics of ion-implanted FET's and to realize process-tolerant MMIC amplifiers.

3350 **(AD-A—196428/7/XAB) Coherent VLSI design environment. Final letter report for period ending 30 September 1987.** Penfield, P. (Massachusetts Inst. of Tech., Cambridge (USA). Microsystems Research Center). 5 May 1988. 8p. NTIS, PC A02/MF A01.

The CAD effort is centered on timing analysis and circuit simulation. Advances have been made in tightening the bounds of timing analysis. The superiority of the Gauss-Jacobi technique for matrix solution, over the Gauss-Seidel method, has been proven when the algorithms are implemented on massively parallel ma-

chines. In the circuits area, one result of importance is a new technique for calculating the highest frequency of operation of transistors with parasitic elements present. Work on a synthesis technique is under way. In the architecture area, many new results have been derived for parallel algorithms and complexity. One of the most astonishing is that a hypercube with a large number of faulty nodes can be used, with high probability, as another perfectly functioning hypercube of half the size, by using reconfiguration algorithms that are simple, fast, and require only local information. Also, the design of the message-driven processor is continuing, with several advances in architecture, software, communications, and ALU design. Many of these are being implemented in VLSI circuits. The theory work has as a central theme that the cost of communication should be included in complexity analyses. This has led to advances in models for computation, including volume-universal networks, routing, network flow, fault avoidance, queue management, and network simulation.

3351 **(AD-A—196526/8/XAB) Transistor sizing in the design of high-speed CMOS (complementary-symmetry metal-oxide-semiconductor) super buffers. Master's thesis.** Steele, G.R. (Naval Postgraduate School, Monterey, CA (USA)). Mar 1988. 145p. NTIS, PC A07/MF A01.

An algorithm for sizing transistors for static Complementary-symmetry Metal-Oxide-Semiconductor (CMOS) integrated-circuit logic design using silicon-gate enhancement-mode Field-Effect Transistors (FET) is derived and implemented in software. The algorithm is applied to the mask-level hardware design of a three-micron-minimum feature-size p-well high-speed super buffer. A software representation of the super buffer can be used for the automated design of custom Very-Large-Scale Integrated (VLSI) circuits.

3352 **(AD-A—196915/3/XAB) Temporal variations in a c-w h-f MOPA (oscillator/amplifier). Final report, 1 April 1985-30 September 1987.** Sentman, L.H. (Illinois Univ., Urbana (USA). Dept. of Aeronautical and Astronautical Engineering). May 1988. 41p. (AAE—88-5). NTIS, PC A03/MF A01.

The experimental and theoretical studies directed toward characterizing the output of a c-w h-f oscillator/amplifier (MOPA) configuration are summarized. Scale effects, when the size of a c-w h-f chemical laser was reduced by a factor of two, were studied experimentally and theoretically. When the saturated gains of the single-channel CL I laser and the two-channel CL II laser were the same, the CL I power was 70-80% of the CL II power. This suggests that for only a 25% performance penalty, the size, weight and gas requirements of a laser can be reduced by a factor of two. The power spectral distributions of the CL I and CL II lasers when the saturated gains were the same, were nearly identical. When the two lasers had the same cavity losses, the CL I power was an average of 45% of the CL II power. The Blaze II and MNOR03SR laser computer simulations gave good agreement with data as a function of mass flow rate, cavity losses, pressure, and size of the laser. Time-dependent oscillations on lines whose saturated gain did not fill the unstable resonator had a period of 47 ns. These oscillations did not occur for Fresnel numbers less than 3.2 and their amplitudes increased as the fraction of the resonator filled by the saturated gain of the oscillating line degreased. A 7 ns oscillation, which was superimposed on top of the 47-ns oscillation, was probably a mode beat of the laser.

3353 **(CONF-880408—39) Design principles for high-frequency microwave cavities.** Kimrey, H.D.; Janney, M.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02. Order Number DE89001875/JAW.

From Spring meeting of the Materials Research Society; Reno, NV, USA (4 Apr 1988).

The characteristics of untuned cavities are determined for microwave processing of alumina. Alumina is a low-loss ceramic that is difficult to heat in the lower microwave region. System efficiency is determined as a function of cavity and workpiece size, frequency, and temperature. With operation at 28 GHz, a cavity applicator can be designed which is capable of generating uniform fields at high efficiency and with a reasonable size. 8 refs., 5 figs.

3354 **(DOE/SF/15930—T1) Gas purged, high pulse rate spark gap evaluation: Final report.** Thayer, W.J.; Lo, V.C.H.; Cousins, A.K. (Spectra Technology, Inc., Bellevue, WA (USA)). 25 Oct 1988. Contract AC03-85SF15930. 192p. NTIS, PC A09/MF A01. Order Number DE89002706/JAW.

Experiments, analyses, and computer modeling have been used to characterize the recovery of innovative, high pulse rate spark gap switches. Both physical and computational models for spark gap recovery have been established and verified through repetitively pulsed experiments. A one-dimensional, unsteady flow computer program and models of important multi-dimensional flow phenomena and radiative transport were developed. Predictions compared very well with test data. Spark gap configurations for tuning pressure wave motion and the associated unsteady flow to enhance the purging of hot spark residue and simultaneously restore the initial gas density were demonstrated at pulse rates to 2500 Hz. Analyses and experiments showed that spark gap systems which use condensable dielectric purge gases such as steam are feasible and will provide a large increase in switch system efficiency at high pulse rates. 15 refs., 82 figs., 5 tabs.

3355 **(PUR—9002172) Annual research summary: July 1, 1987--June 30, 1988.** (Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering). 1988. 260p. NTIS, PC A12/MF A01. Order Number DE89002172/JAW.

This document summarizes the research activities within the School of Electrical Engineering of Purdue University. It is intended as a reference document for colleagues, prospective graduate students and organizations interested in electrical engineering research. The research activities of Part 1 are organized according to ten areas. The first eight of these are areas in which the Purdue Electrical Engineering graduate program is divided for administrative purposes. The ten areas are: Automatic Controls; Bioengineering; Circuit Theory; Communication Sciences; Computer Engineering; Electromagnetic Fields; Energy Sources and Systems; Solid State Devices and Materials; Engineering Education; and Software Development. Since a faculty member may have research attributes in more than one area, not all of his or her project summaries will necessarily appear in the same section. Some summaries because of the interdisciplinary nature of the project, might logically appear in more than one section. In these cases the faculty member's area of major interest dictates the section chosen. This implies that all project summaries on a particular topic do not necessarily appear in the same section.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 3110

3356 **(DPST—88-401) Response to PHEF PHR [Precipitate Hydrolysis Experimental Facility Process Hazards Review] recommendations.** Randall, C.T. (Savannah River Lab., Aiken, SC (USA)). 9 Mar 1988. Contract AC09-76SR00001. 4p. NTIS, PC A02/MF A01. Order Number DE89002444/JAW.

The PHEF Process Hazards Review (PHR) Committee recommended that startup of the Precipitate Hydrolysis Experimental Facility (PHEF) with the four runs originally planned to process a low nitrite (< 0.03 M) precipitate feed proceed as planned. The PHR committee outlined seven action items designed to improve the safety and reliability of the PHEF with respect to process hazards. This memorandum addresses each action item from the PHR Startup Review and outlines the response actions taken or explains why corrective action is judged unnecessary in a particular circumstance. Based on the PHEF Safety Evaluation, the PHEF PHR, and the responses herein, we conclude the PHEF can be safely started as planned. The PHEF will not operate with the Nitrite-Destruction Precipitate Hydrolysis until the action items from the final PHR report are addressed. 3 refs.

3357 **(FMPC/Sub—020) Nitrate destruction by a plasma torch.** Falk, D.E.; Lahoda, E.J.; Mitchell, J.L. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). Sep 1988. Contract AC05-86OR21600. 105p. NTIS, PC A06. Order Number DE89002376/JAW.

This report presents the results of a test program which investigated the feasibility of a plasma-based system to process metal nitrate wastes by transforming them into the corresponding metal oxides and separating these oxides from the gas stream. The test program included performing a thermodynamic study of the proposed process, design and preparation of the actual test program, performance of that test, analyzing the results of the test, and documenting the results of the program in this report. The test was performed for the Westinghouse Materials Company of Ohio (WMCO) by the Westinghouse Environmental Technology Division (now the Environmental Services Division). All testing was completed at the Plasma Center located at the Westinghouse Waltz Mill Site, Madison, Pennsylvania. The primary objective of this proof-of-principle experiment was to demonstrate that raffinate solutions containing nitric acid and various metal nitrates, when treated in a plasma torch reactor, would decompose the nitrates to oxides and that the product solid metal oxides could be separated from the gaseous product nitrogen oxides. 15 figs., 10 tabs.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 2774, 2807, 3076

3358 **(N—88-28142) Thermal barrier coating life-prediction model development. Annual report no. 2.** Strangman, T. E.; Neumann, J.; Liu, A. (Garrett Turbine Engine Co., Phoenix, AZ (USA)). Oct 1986. 91p. (NASA-CR—179507; GTEC—21-5988; NAS—1.26:179507). NTIS, PC A05/MF A01.

The program focuses on predicting the lives of two types of strain-tolerant and oxidation-resistant thermal barrier coating (TBC) systems that are produced by commercial coating suppliers to the gas turbine industry. The plasma-sprayed TBC system, composed of a low-pressure plasma-spray (LPPS) or an argon shrouded plasma-spray (ASPS) applied oxidation resistant NiCrAlY or (CoNiCrAlY) bond coating and an air-plasma-sprayed yttria partially stabilized zirconia insulative layer, is applied by both Chromalloy, Klock, and Union Carbide. The second type of TBS is applied by the electron beam-physical vapor deposition (EB-PVD) process by Temescal. The second year of the program was focused on specimen procurement, TMC system characterization, nondestructive evaluation methods, life prediction model development, and TFE731 engine testing of thermal barrier coated blades. Materials testing is approaching completion. Thermomechanical characterization of the TBC systems, with toughness, and spalling strain tests, was completed. Thermochemical testing is approximately two-thirds complete. Preliminary materials life models for the bond coating oxidation and zirconia sintering failure modes were developed. Integration of these life models with airfoil component analysis methods is in progress. Testing of high pressure turbine blades coated with the program TBS systems is in progress in a TFE731 turbofan engine. Eddy current technology feasibility was established with respect to nondestructively measuring zirconia layer thickness of a TBC system.

4220 Underground Engineering

3359 **(EMR/MR—MRP/ERP/MRL80-43) Mining Research Laboratories annual progress report, 1979/80.** Scott, J.P. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Apr 1980. 193p. (CE—01983). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the activities of Canada's Mining Research Laboratories, consisting of 3 laboratory units in Ottawa and 2 field units in Ontario and Alberta. Energy research activities were carried out in the areas of coal reserves, uranium reserves and production, oil sands mining, ground control methods in coal mining, and explosion and fire safety research and development. Minerals research activities included programs in open pit mining, underground mining, underground nuclear waste disposal, underground and surface mining environments, certification and technical advice under the Explosives Act, and explosives research and development. This document also includes lists of contract reports, external publications, internal reports, and papers presented at various meetings; lists of samples examined and equipment certified; and descriptions of field work and visits. 28 refs., 15 figs.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 2786

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 2762, 3523

4250 Power Cycles

REFER ALSO TO CITATION(S) 2970, 3086, 3087

3360 **(PB—88-869763/XAB) Stirling engines. June 1974-September 1988 (Citations from the International Aerospace Abstracts data base). Report for June 1974-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 179p. NTIS PC N01/MF N01.

Supersedes PB—87-862637; U.S. sales only.

This bibliography contains citations concerning fuel consumption, engine design and testing, computerized simulation, and lubrication systems relative to the Stirling-cycle engine. Solar-energy conversion research, thermodynamic efficiency, economics, and utilization for power generation and automobile engines are included. Materials used in Stirling engines are briefly evaluated. (This updated bibliography contains 390 citations, 66 of which are new entries to the previous edition.)

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 3327, 3439, 3440, 3441, 3442, 3443, 3444, 3445, 3446, 3447, 3448, 3449, 3450, 3451, 3452, 4009, 4011

3361 **(BNL—41858) Spin facilities in North America.** Lowenstein, D.I. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC04-76DP00789. 2p. (CONF-880983—12). NTIS, PC A02/MF A01. Order Number DE89002903/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Spin physics is an important ingredient in the research programs of the major electron and proton accelerators in Canada and the United States. We review here briefly the present and future facilities at TRIUMF, LANL, BNL, FNAL, SSC, Bates, CEBAF, and SLAC.

3362 **(FNAL/C—88/117) Computing possibilities in the mid 1990s.** Nash, T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1988. Contract AC02-76CH03000. 11p. (CONF-8807122—1). NTIS, PC A03. Order Number DE89001247/JAW.

From Conference on future directions in detector R&D for experiments at pp colliders; Snowmass, CO, USA (5 Jul 1988).

This paper describes the kind of computing resources it may be possible to make available for experiments in high energy physics in the mid and late 1990s. We outline some of the work going on today, particularly at Fermilab's Advanced Computer Program, that projects to the future. We attempt to define areas in which coordinated R & D efforts should prove fruitful to provide for on and off-line computing in the SSC era. Because of extraordinary components anticipated from industry, we can be optimistic even to the

level of predicting million VAX equivalent on-line multiprocessor/ data acquisition systems for SSC detectors. Managing this scale of computing will require a new approach to large hardware and software systems. 15 refs., 6 figs.

3363 (LBL—24604, pp 1-14) **Relativistic Heavy Ion Collider Project: an overview.** Ludlam, T.W.; Samios, N.P. Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Four years ago the concept of a heavy ion collider facility, reaching center-of-mass collision energies at least 10 times higher than the fixed target experiments, was identified as the highest priority need for a new facility in the Long Range Plan for basic nuclear research in the US. Immediately thereafter a panel was formed which included leading experimentalists and theorists from both high energy and nuclear physics representing the major interested laboratories throughout the US and in Europe, to consider the basic design requirements for such a facility. This group met for three days in August of 1983 and formulated the essential design parameters for a facility which would reach energies high enough to ensure a baryon-free central region in collisions of the heaviest nuclei; incorporate the flexibility to study collisions of all nuclei, from the lightest to the heaviest; and allow experiments to be carried out over the full range of energies, from a few GeV/amu in the c.m. (AGS fixed target) up to the top collider energy, with no inaccessible gaps, and with adequate intensity for sensitive measurements. The technical parameters were developed for an accelerator complex which would utilize the existing facilities already in place for the ISABELLE/CBA project at Brookhaven with the AGS as injector, thereby saving at least a factor of two in the overall cost of such a collider. This paper discusses the RHIC design, its present status, and its experiments and detectors. 12 references, 6 figures, 1 table.

3364 (LBL—24604, pp 15-20) **Physics at RHIC: what do we want to know, and what do we want to measure?.** Satz, H. (Universitaet Bielefeld (West Germany)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—). Contract AC02-76CH00016.

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

The central topic of this workshop is the planning and design of experiments for the Relativistic Heavy Ion Collider (RHIC) to be constructed at Brookhaven National Laboratory. The author was asked to survey, as a short introduction, the main features of nuclear collisions which we would like to measure at RHIC. He begins by asking: what do we want to known about the physics of high energy heavy ion collisions, and why? He lists what to him are the main questions here. Following that, he indicates some possible experimental ways of addressing these questions. 7 references, 1 table.

3365 (LBL—24604, pp 222-225) **Possible future performance upgrades for RHIC.** Lee, S.Y.; Ruggiero, A.G. Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

At this RHIC workshop several of the working groups have asked what is the maximum luminosity which can ultimately be expected from the machine. This is important from the point of view of the sensitivity of experiments to rare phenomena, as well as the particle-rate capability which must be designed into detector components. A related issue is the length of the interaction diamond: most of the detector designs would like this length to be as small as possible. In order to assist in the design of large detectors, which should be able to take advantage of possible upgrades in the machine performance, the accelerator physics group has examined a plausible (although not guaranteed!) scenario for performance improvements after RHIC becomes operational. Six steps have been proposed as possible means for upgrading the performance of RHIC beyond the specifications of the conceptual Design Report (CDR). While all of these steps are judged feasible, it is unlikely that they would be undertaken until after the machine has been operated successfully at its design specifications, and its detailed performance characteristics become well understood. The net result of these improvements would be, over the long term, about an order of magnitude increase in luminosity, and a reduction of the length of the interaction region to an average value during the beam lifetime of $\leqq$ 20 cm for head-on collisions. Further improvements might be achieved in special insertion regions (mini-beta), and also if it is possible to take full advantage of stochastic cooling.

3366 **(LBL—25937) A new version of a free electron laser Two-Beam Accelerator.** Sessler, A.M.; Sternbach, E.; Wurtele, J.S. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 21p. (CONF-881151—30). NTIS, PC A03/MF A01. Order Number DE89002915/ JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

A new version of a Two-Beam Accelerator is proposed in which in each period of the drive structure a very small input microwave signal is amplified to a large power level and then completely removed and transferred to the accelerating structure. In this manner a number of difficulties with the original version are eliminated or greatly relieved; namely, rf phase and amplitude sensitivity, growth of sidebands, and rf manipulation (removal of the microwaves from the drive structure, and transmission of microwave power through the accelerating cavities). 11 refs., 6 figs., 2 tabs.

3367 **(SLAC-PUB—4741) Summary of the electron accelerators session.** Prescott, C.Y. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 6p. (CONF-880983—7). NTIS, PC A02/ MF A01. Order Number DE89002398/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Since the last High Energy Physics Symposium, there has been considerable progress in the field of polarized electron accelerators. Projects well into construction include the SLC, HERA, and LEP. The status of polarized beams for these projects is discussed in this session. Semiclassical and quantum mechanical calculations of polarizing and depolarizing effects are discussed, for both linear colliders and for storage rings. Substantial progress is continuing in the understanding of depolarizing mechanisms for circular machines. Modelling of these machines is underway. Activities with polarized electron beams at Novosibirsk are described. 8 refs.

3368 **(SLAC-PUB—4761) Status of the SLAC linear collider.** Lueth, V. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 3p. (CONF-880867—7). NTIS, PC A02/MF A01. Order Number DE89002400/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

3369 **(SLAC-PUB—4778) Future proton and electron colliders: Dreams for the 1990's.** Richter, B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 19p. (CONF-880867—9). NTIS, PC A03/MF A01. Order Number DE89002832/ JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

In this paper I have reviewed the possibilities for new colliders that might be available in the 1990's. One or more new proton should be available in the late-90s based on plans of Europe, the US and the USSR. The two very high energy machines, LHC and SSC, are quite expensive, and their construction will be more decided by the politicians' view on the availability of resources than by the physicists' view of the need for new machines. Certainly something will be built, but the question is when. New electron colliders beyond LEP II could be available in the late 1990's as well. Most of the people who have looked at this problem believe that at a minimum three years of R&D are required before a proposal can be made, two years will be required to convince the au-

thorities to go ahead, and five years will be required to build such a machine. Thus the earliest time a new electron collider at high energy could be available is around 1988. A strong international R&D program will be required to meet that schedule. In the field of B factories, PSI's proposal is the first serious step beyond the capabilities of CESR. There are other promising techniques but these need more R&D. The least R&D would be required for the asymmetric storage ring systems, while the most would be required for high luminosity linear colliders. For the next decade, high energy physics will be doing its work at the high energy frontier with Tevatron I and II, UNK, SLC, LEP I and II, and HERA. The opportunities for science presented by experiments at these facilities are very great, and it is to be hoped that the pressure for funding to construct the next generation facilities will not badly affect the operating budgets of the ones we now have or which will soon be turning on. 9 refs., 12 figs., 6 tabs.

3370 **(UCRL—99268-Rev.1) High gradient accelerators for linear light sources.** Barletta, W.A. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1988. Contract W-7405-ENG-48. 52p. (CONF-8806263—1-Rev.1). NTIS, PC A04/MF A01. Order Number DE89001124/JAW.

From International school on electromagnetic radiation and particle beams: physics and applications; Varenna, Italy (20 Jun 1988).

Ultra-high gradient radio frequency linacs powered by relativistic klystrons appear to be able to provide compact sources of radiation at XUV and soft x-ray wavelengths with a duration of 1 picosecond or less. This paper provides a tutorial review of the physics applicable to scaling the present experience of the accelerator community to the regime applicable to compact linear light sources. 22 refs., 11 figs., 21 tabs.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 3370

3371 **(AD-A—196747/0/XAB) Electron-ring extraction scheme from the modified betatron accelerator. Interim report.** Kapetanakos, C.A.; Marsh, S.J.; Dialetis, D. (Naval Research Lab., Washington, DC (USA)). 27 Jun 1988. 35p. (NRL-MR—6214). NTIS, PC A03/MF A01.

This report describes an extraction scheme that is easily realizable and has the potential to lead to very high extraction efficiency. The proposed extraction scheme is based on the transformation of the circulating electron ring into a stationary helix, in the toroidal direction, by exciting the resonance that naturally exists for some specific values of the ratio of the vertical to toroidal magnetic field. Transformation of the ring into a helix is achieved with a localized vertical magnetic field disturbance that is generated by an agitator coil. As the minor radius of the helix increases with each passage through the gap of the agitator coil, the electrons eventually reach the extractor, which has the property that all the magnetic field components transverse to its axis are equal to zero. Thus, the electron ring unwinds into a straight beam. A technique is proposed for extracting the electron ring from the modified betatron accelerator. Basically, this technique consists of exciting the resonance that naturally exists for some specific values of the ratio of the vertical to toroidal magnetic field.

3372 **(AD-A—196789/2/XAB) Beam handling and emittance control. Technical report, 1 September 1986-28 February 1988.** Thompson, J.R.; Sloan, M.L.; Moore, B.N.; Uglum, J.R. (Austin Research Associates, Inc., TX (USA)). 15 Jul 1988. 65p. (I-ARA—88-U-24). NTIS, PC A04/MF A01.

This report reviews the results of calculations which concern techniques of beam handling and emittance control for high-current beams in advanced accelerators. Beam-quality requirements for acceptable performance of beam-driven-free electron laser devices for SDI missions are examined. The beam quality achievable in high-current, space-charge-limited diodes is reviewed and found to be potentially high. Emittance growth during gas-focused transport due to streaming instabilities between beam electrons and gas ions is briefly examined, and estimated to be modest. The principal threat to beam-quality degradation is estimated to occur during the lengthy process of acceleration and transport past protuberances, constrictions, or discontinuities in the waveguide wall, or during beam aperturing. A Hamiltonian-theoretic analysis of emittance growth during high-current electron-beam transport, coupled with an envelope equation analysis of the induced transverse-beam oscillations, is applied to develop scaling laws for the emittance growth suffered during such events as beam acceleration, propagation past irises or constrictions in the waveguide wall, beam aperturing, and axial variation in the magneticguide field strength. Criteria area developed for preventing excessive emittance growth by avoiding abrupt axial variations and providing sufficiently strong focusing forces. Designed variations in the waveguide wall shape and and in the strength of the magnetic-guide field may be introduced to greatly reduce emittance growth during such events as beam acceleration.

3373 **(BNL—41799) Compact high flux photon beam position monitor.** Johnson, E.D.; Oversluizen, T. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 11p. (CONF-8808141—5). NTIS, PC A03/MF A01. Order Number DE89001103/JAW.

From 3. international conference on synchrotron radiation instruments; Tokyo, Japan (29 Aug 1988).

We have developed a new compact water-cooled beam position monitor for use at the NSLS X-13 Insertion Device Development beamline, currently fitted with a high power, high brightness soft x-ray undulator. We describe the novel geometry of the monitor and present the results of tests which explore its sensitivity, stability and linearity. These results were obtained on the NSLS Beamline Research and Development white light beamline, U14B, on the VUV ring and suggest that beam position monitors of this type might be adapted to other facilities with similar spectral characteristics. 5 refs., 5 figs.

3374 **(BNL—41810) Synchrotron radiation.** Knotek, M.L. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 6p. (CONF-8710367—2). NTIS, PC A03/MF A01. Order Number DE89002181/JAW.

From 3. symposium on Pan-American collaboration in experimental physics; Rio de Janeiro, Brazil (19 Oct 1987).

Synchrotron radiation has had a revolutionary effect on a broad range of scientific studies, from physics, chemistry and metallurgy to biology, medicine and geoscience. The situation during the last decade has been one of very rapid growth, there is a great vitality to the field and a capability has been given to a very broad range of scientific disciplines which was undreamed of just a decade or so ago. Here we will discuss some of the properties of synchrotron radiation that makes it so interesting and something of the sources in existence today including the National Synchrotron Light Source (NSLS). The NSLS is one of the new facilities built specifically for synchrotron radiation research and the model that was developed there for involvement of the scientific community is a good one which provides some good lessons for these facilities and others.

3375 **(DESY—86-057) Action-angle variables of classical spin motion in circular accelerators.** Yokoya, Kaoru. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1986. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755557/JAW.

A general formalism is presented which shows how to rewrite a given Hamiltonian involving classical spin motion in an action-angle variable representation. The canonical transformation is made using the Lie transformation technique.

3376 **(DESY—86-081) Coupling of transverse and longitudinal collective motions due to closed orbit distortion and dispersion in a two-particle model.** Chin Yongho. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1986. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755559/JAW.

In order to explain the large discrepancy between the measured transverse coherent tune shifts and analytical ones in a short bunch in PETRA, the effects of the closed orbit distortion y/sub co/ and the dispersion eta on a beam instability is studied with a two-particle model. It follows the result which supports Kohaupt's previous results; they hardly contribute to real tune shift, while the momentum dependence of the wake force can make a beam unstable, with the growth rate which is proportional to the product of y/sub co/ and eta.

3377 **(DESY—86-084) Cumulative beam breakup in large-scale linacs.** Yokoya, Kaoru. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1986. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755560/JAW.

The cumulative transverse beam breakup in large linacs such as the ones for linear colliders is discussed. Various analytic formulae are derived which allow arbitrary initial condition, focussing and acceleration. The spread in the mode frequency can be taken into account. The misalignment problem is also discussed.

3378 **(DESY—86-097) Landau damping of a multi-bunch instability due to bunch-to-bunch tune spread.** Chin, Y.H.; Yokoya, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1986. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755561/JAW.

A transverse multi-bunch instability in the presence of a split in the betatron tunes between individual bunches is studied. The formalism is summarized in a dispersion relation. It is found that the simple sinusoidal tune modulation by means of an RFQ produces no stable area in the stability diagram. Two cures are presented for expansion of the stable region. One of them, that using fractional filling of bunches, has an advantage that the width of stable band can be controlled by varying the number of missing bunches.

3379 **(DESY—86-147) Nonlinear theory of coupled synchro-betatron motion.** Barber, D.P.; Mais, H.; Ripken, G.; Willeke, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1986. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755563/JAW.

In this paper we present a non-linear theory of coupled synchro-betatron oscillations which includes as special cases the well-known theory of nonlinear betatron oscillations and the theory of satellite resonances. The method is based on a 6-dimensional canonical formalism in which, after introducing dispersion, all three unperturbed modes are described by Twiss parameters. These Twiss parameters have a more general form than those defined in the usual machine theory of Courant, Livingstone and Snyder. The resonances are then investigated using canonical perturbation theory in a way already familiar from its application to non-linear betatron motion. Selected applications are discussed.

3380 **(DESY—87-011) Stability of a colliding beam in a linear collider.** Chin, Y.H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755566/JAW.

Plasma fluid instabilities of a beam collision in a linear collider are studied. A dispersion relation for the instability of arbitrary order is derived from both the fluid equation and the kinetic equation. The analysis shows that for a single collision these instabilities are negligible even for a large disruption parameter (e.g., $\simeq$ 10). However, in the multiple-bunch collision case, the cumulative effect of small growth of instability may reduce the luminosity in spite of the small disruption parameter for each bunch.

3381 **(IAE—4523/14) Simulation of electron acceleration in an ondulator.** Varfolomeev, A.A.; Lachin, Yu.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 13p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704685/JAW.

Electron and laser beam interaction in the field of a profiled ondulator is theoretically calculated. Electron capture in the acceleration regime is shown to take place when complying with the conditions of interaction synchronism. Expressions for acceleration rate and dimensions of the phase stability range are obtained. The results of numerical simulation of $\sim$ 60 MeV electron acceleration for Nd- and Co/sub 2/-lasers with account of initial energy spread of an electron beam are presented. 7 refs.; 7 figs.

3382 **(ITEF—38(1988)) Difference schemes of fourth order accuracy for integration of high-current beam motion selfconsistent equations.** Vorob'ev, L.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704814/JAW.

Difference schemes for solution of beam motion equations ensuring the fourth order of time accuracy and conservative nature of the numerical solution are plotted based on the integral-interpolation method. Functions of external focusing in motion equations may be not obligatory smooth, but they may have breaks of the first order; in this case accuracy and conservative nature are preserved. The integration formulae are derived for alternating pitch, that permits to vary the integration pitch depending on the rate of changing the envelope. A computerized program was developed on the basis of the obtained results, its operation is illustrated by numerical methods. 10 refs.

3383 **(JINR-R—9-88-24) Computerized simulation of nonlinear space-charge longitudinal waves in ring beams.** Beloshitskij, P.F.; Kazarinov, N.Yu.; Perel'shtejn, Eh.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1988. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704875/JAW.

Submitted to the journal Zh. Teor. Fiz. .

Nonlinear space-charge longitudinal waves are investigated in relativistic ring beams of charged particles with negative effective mass. These waves are bunches circulation over orbit with angular velocity equal to the frequency averaged over all particles. The existence of such waves if dissipation is present in the system is shown. The bunch stability is investigated by the computerized simulation method. It is shown that bunches with the energy spread smaller than the linear theory threshold are stable against long-wave disturbances if their angular size is small enough. Coherent stability of a set of symmetrically placed over the orbit bunches could be achieved by implied electromagnetic wave of moderate amplitude travelling over the orbit. 5 refs.; 5 figs.

3384 **(LBL—25099) Transverse mis-alignments in a driver.** Smith, L.; Hahn, K. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 8p. (CONF-8806101—4). NTIS, PC A02/MF A01. Order Number DE89002671/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

The transverse errors of the beam lines are usually corrected by an appropriate feed back to bring the beam back on axis. In an induction linac, however, the head and tail of the bunch differ substantially in momentum at a given lens location. As a result, the correction has to be time dependent. Such a correction becomes increasingly difficult as the beam energy increases and the time duration of the bunch decreases. As a step towards an understanding of the problem, we have analyzed the extreme case of applying no correction. Since the lattice configuration changes and the transverse oscillations are damped as the ions are accelerated, the rms amplitude does not increase simply as the square root of the number of periods, as one would expect for constant velocity in a uniform channel. 2 refs., 2 figs.

3385 **(LBL—25759) Plasma suppression of beamstrahlung.** Whittum, D.H.; Sessler, A.M.; Stewart, J.J.; Yu, S.S. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098;W-7405-ENG-48. 26p. (CONF-8806258—1). NTIS, PC A03/MF A01. Order Number DE89001253/JAW.

From Workshop on physics of linear colliders; Capri, Italy (13 Jun 1988).

We investigate the use of a plasma at the interaction point of two colliding beams to suppress beamsstrahlung and related phenomena. We derive conditions for good current cancellation via plasma return currents and report on numerical simulations conducted to confirm our analytic results. 10 refs., 5 figs., 4 tabs.

3386 **(LBL—25807) RF and space-charge effects in laser-driven rf electron guns.** Kim, Kwang-Je. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 45p. (CONF-8808141—6). NTIS, PC A03/MF A01. Order Number DE89002669/JAW.

From 3. international conference on synchrotron radiation instruments; Tokyo, Japan (29 Aug 1988).

The evolution of the electron-beam phase space distribution in laser-driven rf guns is studied by taking into account both the time variation of the RF field and space-charge effects. In particular, simple formulas are derived for the transverse and longitudinal emittances at the exit of the gun. The results are compared and found to agree well with those from simulation. 10 refs., 7 figs.

3387 **(SLAC-CN—369) Orthogonality of final waist corrections at the IP of the SLC.** Bambade, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 27 Oct 1988. Contract AC03-76SF00515. 8p. NTIS, PC A02/MF A01. Order Number DE89002743/JAW.

Because the SLC final IP spot is produced by an aberration-dominated optical system, all components and couplings between dimensions of transverse phase-space must be controlled in the experimental tuning algorithm. For equal emittances ϵ/sub x/ = ϵ/sub y/, this amounts to ten linear optics adjustments. These adjustments are coupled and depend non-linearly on phase-space parameters. A ten-dimensional non-linear fitting program is therefore used to match the lattice in the Final Focus to the input beam. Local orthogonal "knobs" are also defined for fine-tweaking around the initial solution, although this is not always practical because of steering from the lenses. The three final waist corrections are however fully orthogonal to the other seven optical adjustments. This means that they do not cause any of the other seven optical distortions. We refer to this as external orthogonality. They can also be made internally orthogonal. This means that each one of the three orthogonalized controls can be applied independently of the two others. It also allows one to simultaneously correct and determine the phase-space at the IP.

3388 **(SLAC-PUB—4724) Model-based expert systems for linac computer controls.** Lee, M.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 5p. (CONF-881049—28). NTIS, PC A02/MF A01. Order Number DE89002395/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The use of machine modeling and beam simulation programs for the control of accelerator operation has become standard practice. The success of a model-based control operation depends on how the parameter to be controlled is measured, how the measured data is analyzed, how the result of the analysis is interpreted, and how a solution is implemented. There is considerable interest in applying expert systems technology that can automate all of these processes. The design of an expert system to control the beam trajectory in linear accelerators will be discussed as an illustration of this approach. 4 figs., 1 tab.

3389 **(SLAC-TN—87-4-Rev.) Writing SUBROUTINE HOWFAR for EGS4.** Nelson, W.R.; Jenkins, T.M. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 31 Aug 1988. Contract AC03-76SF00515. 20p. NTIS, PC A03/MF A01. Order Number DE89002410/JAW.

The purpose of this note is to provide guidance, in addition to that given in SLAC-265, in writing SUBROUTINE HOWFAR for both simple and complex geometrical situations. Since most complex geometries can be represented in terms of blocks of simpler geometries, a number of geometry subprograms have been created for use within HOWFAR. They are provided as part of the EGS4 Code System, which means that they are located in files on the EGS4 disk under VM/SP at SLAC. They are also on the EGS4 Distribution Tape that is given out on request by the SLAC Radiation Physics Group. What we hope to accomplish with this note is to show how to create EGS4 geometries in a modular fashion, with particular emphasis on using the macro equivalents of the subroutines in order to gain efficiency. It is assumed that the reader is already familiar with EGS4 and understands the role of the variables USTEP, IDISC, and IRNEW as they apply to SUBROUTINE HOWFAR. If not, then the reader is advised to study Appendix 2 of SLAC-265 first. The tutorial chapter may also provide some insight. 5 refs., 10 figs.

3390 **(UCRL—99725) Theoretical understanding of ATA laser-guided transport.** Boyd, J.K.; Caporaso, G.J. (Lawrence Livermore National Lab., CA (USA)). 29 Sep 1988. Contract W-7405-ENG-48. 6p. (CONF-8809149—24). NTIS, PC A02/MF A01. Order Number DE89002663/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

Many laser-guided transport experiments have been performed on the ATA accelerator. The results of these experiments are dominated by the observed head to tail pulse radius and emittance variation. The primary mechanisms responsible for this behavior are spatially dependent focusing (axial and transverse), time dependent focusing, ion production and dynamics, and secondary electron effects. These mechanisms have been studied in axisymmetric calculations and non- axisymmetric calculations. The axisymmetric calculations have obtained from the DPC, ENV and ST computer codes. The non-axisymmetric calculations have been obtained from the BENDER code. Laser-guided transport relies on the ionization of a background gas (benzene is used in ATA) by a laser, and the subsequent formation of an ion channel caused by the expulsion of the plasma electrons responding to the passage of a relativistic electron beam. The focusing behavior of the ion channel is complicated by the fact that the ions are mobile on the time scale of the electron beam pulse length. Because the ions are primarily moving radially as a result of the electron beam radial electric field, the response time scale decreases as the beam current increases. Experiments have shown a current threshold for undesirable beam radius increase. To assist in understanding this behavior, in addition to numerical calculations the secondary electron effects and basic ion radial oscillation can be studied with approximate analytic models. The main items of interest are the time scale of the first half cycle of radial ion oscillation and whether or not the secondary electrons are expelled, as intended. 4 figs.

3391 **(UCRL—99780) Novel non-intercepting diagnostic techniques for low-emittance relativistic electron beams.** Moran, M.J.; Chang, B. (Lawrence Livermore National Lab., CA (USA)). 30 Sep 1988. Contract W-7405-ENG-48. 12p. (CONF-881151—29). NTIS, PC A03/MF A01. Order Number DE89002870/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Relativistic electron beams are being generated with emittances low enough that diffraction radiation can be used for beam diagnostics. Techniques based on diffraction radiation can be used to measure the beam transverse momentum distribution and to measure the transverse spatial distribution. The radiation is intense and can be in the visible spectral region where optical diagnostic techniques can be used to maximum advantage. 4 refs. 3 figs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 3304, 3373, 3391, 3795

3392 **(BNL—41767) Development of a high brightness electron gun for the Accelerator Test Facility at Brookhaven National Laboratory.** Batchelor, K.; Kirk, H.; Sheehan, J.; Woodle, M.; McDonald, K. (Brookhaven National Lab., Upton, NY (USA); Princeton Univ., NJ (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-880695—67). NTIS, PC A02/MF A01. Order Number DE89002179/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

An electron gun utilizing a radio frequency accelerating cavity operating at a frequency of 2856 MHZ is described. Low level tests of a model cavity designed for use with either a thermionic or laser driven photo-cathode are presented. Calculations for a laser driven photo-cathode at a bunch charge of 1nC in a 5 psec bunch are given. With this configuration we hope to achieve an emittance ($\gamma\sigma$/sub x/σ/sub x/) of 5 to 10 {times} 10/sup {minus}6/ m {center←dot} rad at an output energy of 4.85 MeV for a 1nC charge. 9 refs., 10 figs., 4 tabs.

3393 **(DOE/ER/13585—T1) Application of high power modulated intense relativistic electron beams for the development of a wake-field accelerator: Progress report: Second year.** (Oak Ridge Associated Universities, Inc., TN (USA)). [1988]. Contract AC05-76OR00033. 83p. NTIS, PC A05. Order Number DE89002677/JAW.

This paper discusses the continued investigation of the interaction of a large diameter high current-low voltage modulated electron beam with accelerating structures. Various structure geometries are tested and the induced electric fields are measured and mapped. A second low current electron beam is injected into the structures and its energy gain is measured. Optimization and simulation of the acceleration mechanism is discussed as well.

3394 **(DOE/ER/40155—1-Vol.1) [Superferric Super Collider R and D Collaboration]: Final technical report: Volume 1.** Huson, F.R. (Houston Area Research Center, The Woodlands, TX (USA)). Jul 1987. Contract AC02-84ER40155. 175p. NTIS, PC A08. Order Number TI89002475/JAW.

The idea of using a superferric magnet for a large accelerator such as the SSC arises from three considerations: Low Current. If the field is dominated by the iron, then the current is minimized. Forces and stored energy are lower by an order of magnitude than coil dominated magnets. Persistent currents and field errors due to coil placement are negligible; Simple and Reliable. Since the current is low and the number of turns is 8, the magnets are much simpler to construct and easier to operate. Reliability should be very good; and Inexpensive. The dominant cost of a superconducting magnet is the superconductor. The total cost of superconductor is directly proportional to the ampere-turns. Superferric magnets have 1/4 or less total pounds of superconductor than the 5 or 6.5 T magnets. This report describes a design of a superferric magnet that satisfies the three previous conditions. The first section of the report discusses a lattice that is designed for this magnet. The body of the report discusses the design, construction, assembly and installation of the magnets. The cryogenic section describes a complete system including cooldown, warm-up, steady state and quenches. The power supply is described with the quench detection and response system. Finally, the instrumentation is discussed.

3395 **(FNAL/C—88/106) Measurements of neutrons in enclosures and outside of shielding at the Tevatron.** Cossairt, J.D.; Elwyn, A.J.; Freeman, W.S.; Salsbury, W.C.; Yurista, P.M. (Fermi National Accelerator Lab., Batavia, IL (USA)). 25 Aug 1988. Contract AC02-76CH03000. 11p. (CONF-881232—2). NTIS, PC A03/MF A01. Order Number DE88017124/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The characteristics of the spectra of neutrons produced by the losses of accelerated proton beams both within accelerator enclosures and outside of shielding has been determined from measurements at various locations around the Fermilab Tevatron and its associated experimental areas. The measurements were performed with a multisphere spectrometer consisting of either ^{6}LiI scintillators or /sup 6,7/LiF TLD's placed at the centers of moderating polyethylene spheres with diameters ranging from 5.08 to 45.7 cm. The fluence and dose equivalent energy distributions and average quality factors obtained from spectrum unfolding calculations are summarized for this accelerator environment. 22 refs., 8 figs., 3 tabs.

3396 **(IFVE-OEA—87-197) On-line system for measuring electrophysical characteristics of superconducting wires.** Aleksandrov, A.G.; Vybornov, M.G.; Goremykin, A.G. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 13p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704770/JAW.

A system for measuring electrophysical characteristics of superconducting wires, containing a set of SUMMA modules controlled by "Elektronika-60" microcomputer is described. The system is intended for measuring magnetization, dynamic losses and critical current density in superconducting wires. The system structure, measurement methods and algorithm, the results obtained are presented. 6 refs.; 6 figs.; 2 tabs.

3397 (INIS-BR—1275, pp 28) **Construction of four reflection monolithic monochromator suppressing harmonics for synchrotron radiation.** Baran, Z.; Cusatis, C.; Mazzaro, I. (Bahia Univ., Salvador (Brazil); Parana Univ., Curitiba (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3398 **(IYF-R—2-304) Overlopped pulse discriminator for experiments on the IYaF AN Uz.SSR U-150 cyclotron.** Gulamov, I.R.; Karakhodzhaev, A.A. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704827/JAW.

Overlapped pulse discriminator in CAMAC standard applied in experiments conducted in U-150 cyclotron is described. Its characteristics are presented. Energy spectra produced under /sup 3/He ion elastic scattering on /sup 197/Au target at scattering angle θ/sub lab/=5 deg using overlapping discriminator and without overlapped signal discrimination, are presented. With the introduction of the overlapped signal discriminator the background is sufficiently reduced and the peak fencing is removed corresponding to coincidence of signals from elastically scattered particles from the neighbouring clusters. 1 ref.; 4 figs.

3399 **(JINR—9-88-25) Numerical simulation of a magnetic field in superconducting quadrupoles for nuclotron.** Borisovskaya, Z.V.; Zhidkov, E.P.; Smirnov, A.A.; Smirnova, L.A.; Shelaev, I.A. (Joint Inst. for Nuclear Research, Dub a (USSR). Lab. of Computing Techniques and Automation; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704830/JAW.

A magnetic field of regular cell quadrupoles for the superconducting of relativistic nuclei has been numerically modelled. The spatial field has been calculated by the method of volume integral equations using the system of MAGSYS programs and the central field by the conjugate gradient method with the help of the POISSON program (POISCR). The accuracy of calculating the gradient of the central field of the quadrupoles is about 10/sup -4/ and the accuracy of calculation of relative amplitudes of higher harmonic (C/sub 4/,C/sub 6/) of about 10/sup -5/. An optimized version of a symmetric lens with hyperbolic pole profile and one-layer coil is chosen in the studies of variety of lens types. Nonlineariaty of the gradient of such a lens is within allowable limits (2.8%) with increasing the current in the S winding up to a maxi-

mum. The relative amlitude of the C/sub 6/ harmonic is less than 0.12%. The technology of construction of lenses of hollow superconductor is taken into account to choose the operating vesrion. 7 refs.; 8 figs.; 7 tabs.

3400 **(JINR—9-88-62) Computerized simulation of a magnetic structure of the superconducting cyclotron.** Alenitskij, Yu.G.; Chesnova, S.I.; Leonov, V.V.; Khodakov, E.M.; Shlejfman, V.Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704831/JAW.

Geometric parameters of a magnetic structure of the isochronous cyclotron for accelerating ions with A/Z=2 upto 30 MeV/nucl energy are determined. The shape of electromagnet three spiral shims for the pole piece diameter of 185 cm has been calculated. The current superconducting coils placed near the middle place was used for increasing the magnetic field upto 2.2 T. The calculation was made by means of ANALYS, POISSON and FERRIUM programs which calculated magnetostatic field with different approximation. Dimensions of spiral, ring shims and current coils for 175 cm and 185 cm diameters of spirals are chosen. 4 refs.; 10 figs.

3401 **(LA-UR—88-3328) New photoelectric injector design for the Los Alamos National Laboratory XUV FEL accelerator.** Carlsten, B.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8808146—3). NTIS, PC A03/MF A01. Order Number DE89002044/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

The injector for the Los Alamos National Laboratory XUV FEL accelerator has been redesigned to provide more charge to the wiggler. The new design can deliver 8nC of charge within 20 ps with a normalized 90% emittance of <25 {Pi}{center←dot}mm{center←dot}mrad to the wiggler at an energy of 200 MeV. In addition to the new design of the injector, we analyze the emittance growth and subsequent reduction through the injector, including different mechanisms for emittance growth and the methods used to eliminate the correlated emittance. 7 refs., 5 figs.

3402 **(LA-UR—88-3363) A preliminary design of the Los Alamos fast Kicker Magnet Pulser and Power Supply.** Winje, R.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-8810196—1). NTIS, PC A02/MF A01. Order Number DE89002037/JAW.

From Magnet design workshop; Vancouver, Canada (3 Oct 1988).

The technical design of the Kicker Magnet Pulser and Power Supply is based on the switching of a precharged pulse forming network (pfn) into a matched load. Provisions are made through the selection of the main switch tube to accommodate loads that are not matched to the pfn impedance. The paper includes a description of the major components of the power supply and a summary of the performance parameters. 4 figs., 3 tabs.

3403 **(LBL—24993) Considerations against a force compensated coil.** Hassenzahl, W. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 5p. (CONF-880812—21). NTIS, PC A02/MF A01. Order Number DE89002672/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

The cost of structural components in a large superconducting coil may well exceed the coil and cryostat cost. As a result, the idea of constructing a system composed of two different coil types assembled in such a way that the forces balance and reduce the total structural requirement is oft proposed. A suitable geometry has never been found for the fundamental reason that there can be no force compensated solution. In this paper, the general problem is presented and an analysis of the energy stored and stresses produced in the structure are described in a fundamental way. Finally, the relation between structural mass M and stored energy E, M ≧ {rho}E/σ/sub w/, that is valid for all magnetic systems is developed, where {rho} is the density of the structure and σ/sub w/ is the working stress in the structure. 8 refs., 2 figs.

3404 **(LBL—25630) Compensation of beam loading in the ALS injector linac.** Selph, F. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 3p. (CONF-881049—35). NTIS, PC A02/MF A01. Order Number DE89002924/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

For the Advanced Light Source (ALS) 50 MeV injector linac, a modest level of beam loading is expected, which if uncompensated, will cause an energy spread greater than 4% in the beam intended for the booster synchrotron. Use is made of the fact that the linac consists of two equal, independently driven sections. Phase jumps of appropriate amount are introduced, which effectively, result in a power step to offset the beam loading.

3405 **(LBL—25699) Conceptual design of a bright electron injector based on a laser-driven photocathode rf electron gun.** Chattopadhyay, S.; Chen, Y.J.; Hopkins, D.; Kim, K.J.; Kung, A.; Miller, R.; Sessler, A.; Young, T. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 3p. (CONF-881049—37). NTIS, PC A02/MF A01. Order Number DE89002959/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Conceptual design of a bright electron injector for the 1 GeV high gradient test experiment, envisaged by the LLNL-SLAC-LBL collaboration on the Relativistic Klystron is presented. The design utilizes a high-brightness laser-driven rf photocathode electron gun, similar to the pioneering LANL early studies in concept (different parametrically however), together with achromatic magnetic bunching and transport systems and diagnostics. The design is performed with attention to possible use in an FEL as well. A simple but realistic analytic model including longitudinal and transverse space-charge and rf effects and extensive computer simulation form the basis of the parametric choice for the source. These parameters are used as guides for the design of the picosecond laser system and magnetic bunching section. 4 refs., 5 figs., 2 tabs.

3406 **(LBL—25936) An FEL power source for a TeV linear collider.** Hopkins, D.B.; Hoyer, E.H.; Halbach, K.; Sessler, A.M.; Barletta, W.A.; Jong, R.A.; Reginato, L.L.; Yu, S.S.; Bayless, J.R.; Palmer, R.B. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098;AC03-76SF00515;W-7405-ENG-48;AC02-76CH00016. 30p. (CONF-881049—36). NTIS, PC A03/MF A01. Order Number DE89002913/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

In this paper we consider the design of a power source of a linear collider. We take a conservative approach and hence extrapolate as little as possible from present experience. Thus we establish a "straw man"; i.e., a design which serves as an "existence proof" of a power source for a TeV collider. We take as the parameters to which the power source is designed those presented earlier by R. Palmer; namely: f = 17 GHz, W = 634 MW/m, L = 1.44m, W/sub T/ = 3.87 TW, R = 180 Hz, L/sub c/ = 7.41 km, T/sub p/ = 50 ns, where the quantity f is the desired frequency, W is the power needed per meter (for a gradient of 186 MeV/m), L is the length between feeds, W/sub T/ is the total power required, R is the rep-rate, L/sub c/ is the total length of the collider, and T/sub p/ is the rf pulse width. With no emittance dilution, this collider would produce a luminosity of 7.7 {times} 10^{32} cm/sup {minus}2/ sec/sup {minus}1/ for single bunch operation or 1.6 {times} 10^{34} cm/sup {minus}2/ sec/sup {minus}1/ for multi-bunch operating (i.e., 21 bunches). With realistic dilution and R = 386 Hz these luminosity values would be 5.0 {times} 10^{32} and 1.0 {times} 10^{34} cm/sup {minus}2/ sec/sup {minus}1/, respectively. 5 refs., 14 figs., 4 tabs.

3407 **(NIIEFA-P-V—0753) Investigation of oxide-nickel thermocathode surface.** Alekseev, Yu.V.; Kanicheva, I.R.; Korablev, V.V.; Pavlov, V.K.; Popov, A.N.; Prudnikov, I.A. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704890/JAW.

A pressed oxide-nickel cathode has been applied for a long time in injectors of waveguide accelerators of specific current selections of 1-2 A/cm/sup 2/. Data on electron work function and element composition of the surface of the pressed oxide-nickel thermocathode (BN-cathode) in different operation periods in the regime of current selection obtained by the methods of measuring thermoemission current, contact difference of potentials, registration of the coefficient of secondary electron emission, electron auger-spectroscopy and spectroscopy of characteristic losses of electron energy are presented. 8 refs.; 8 figs.

3408 **(SLAC-PUB—4704) SLC [SLAC Linear Collider] positron source startup.** Clendenin, J.E.; Bartha, G.; DeStaebler, H.; Ecklund, S.; Helm, R.H.; Keller, L.P.; Kulikov, A.V.; Odian, A.C .; Ross, M.; Truher, J.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 3p. (CONF-881049—33). NTIS, PC A02/MF A01. Order Number DE89002845/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The turnon experience and initial operating parameters of the SLAC Linear Collider positron source are described. 6 refs., 7 figs.

3409 **(SLAC-PUB—4719) Transient analysis of multicavity klystrons.** Lavine, T.L.; Miller, R.H.; Morton, P.L.; Ruth, R.D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 3p. (CONF-881049—31). NTIS, PC A02/MF A01. Order Number DE89002392/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

We describe a model for analytic analysis of transients in multicavity klystron output power and phase. Cavities are modeled as resonant circuits, while bunching of the beam is modeled using linear space-charge wave theory. Our analysis has been implemented in a computer program which we use in designing multicavity klystrons with stable output power and phase. We present as examples transient analysis of a relativistic klystron using a magnetic pulse compression modulator, and of a conventional klystron designed to use phase shifting techniques for RF pulse compression. 4 refs., 4 figs.

4304 Storage Rings

REFER ALSO TO CITATION(S) 3383, 3741, 3742

3410 **(DESY—86-079) Chromatic corrections and dynamic aperture in the HERA electron ring. Pt. 1.** Brinkmann, R.; Willeke, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1986. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755558/JAW.

Achromatic optical solutions for the HERA e/sup -/-ring are presented and discussed. The dynamic aperture for the three different optics is studied by particle tracking and perturbation theory. We found a significant advantage of quasi-superperiodic solutions with respect to the non-periodic solutions and an advantage of a 6-sextupole family solution with respect to a 2-family solution. The sextupole acceptance for the preferred optical solution is as large as 27 standard deviations at a beam energy of 35 GeV.

3411 **(DESY—86-121) Damping of multi-bunch oscillations by a narrow-band feedback system using frequency splitting between bunches.** Kohaupt, R.D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1986. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755562/JAW.

In this article it is shown that, indeed, the bandwidth necessary for damping multi-bunch oscillations can be drastically reduced.

3412 **(DESY—86-171) Experimental study of a new multi-bunch damping mechanism in PETRA.** Heins, D.; Kohaupt, R.D.; Kriens, W.; Leneke, M.; Matthiesen, K.H.; Musfeldt, H.; Paetzold, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1986. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755565/JAW.

In this article we describe the experiment which has been performed in PETRA in order to demonstrate the existence of the damping mechanism based on a combination of a narrow-band feedback system and frequency splitting between bunches. (orig./HSI).

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 2814, 2902, 2965, 2988, 2991, 3539, 3605, 3710, 3729, 3741, 3742, 3794, 3820, 3881

3413 **(AD-A—196496/4/XAB) Fabricate, calibrate, and test a dosimeter for integration into the CRRES (Combined Release and Radiation Effects Satellite) satellite. Technical report.** Morel, P.R.; Hanser, F.A.; Sellers, B.; Cohen, R.; Kane, B.D. (Panametrics, Inc., Waltham, MA (USA)). Mar 1988. 37p. (SCIENTIFIC—5). NTIS, PC A03/MF A01.

A Space Radiation Dosimeter was fabricated, calibrated, tested, and has undergone successful integration testing in the CRRES spacecraft. This Dosimeter is essentially identical to that previously designed, fabricated, calibrated, tested, and integrated into the DMSP F7 satellite. These dosimeters are primarily designed to measure the dose from electrons of greater than 1 MeV to greater than 10 MeV in four channels. Each channel has a different thickness aluminum dome.

3414 **(AERE-R—13002) Alpha-recoil proportional counter to measure neutron energy spectra between 2 MeV and 15 MeV.** Birch, R. (UKAEA Harwell Lab. Environmental and Medical Science Div.). Feb 1988. 57p. H.M. Stationery Office, London, price Pound 12.00.

A cylindrical alpha-recoil proportional counter has been developed to measure neutron energy spectra between 2 MeV and 15 MeV. The counter, which has an active length of 300 mm and a radius of 25 mm, is filled with 600 kPa /sup 4/He plus 400 kPa Ar. The counter has been calibrated with monoenergetic neutrons in the low-scatter facility of the National Physical Laboratory. In addition, a Monte Carlo code has been developed to calculate the response functions of the counter and to interpolate between the measured response functions. Unfolding codes, necessary to obtain the neutron spectrum from the measured pulse-height distribution, have been developed. A number of measurements were undertaken to determine whether the counter and unfolding programs operated satisfactorily for broad-energy neutron spectra. Measurements include the neutron spectrum from an Am-Be source, and the leakage spectrum through a shield on the ASPIS facility on the NESTOR reactor at AEE Winfrith. The spectra determined with the alpha-recoil counter show very good agreement with other measurements and calculations.

3415 **(AERE-R—13010) Development and calibration of large volume proton-recoil counters for neutron spectrometry in radiological protection.** Delafield, H.J.; Birch, R. (UKAEA Harwell Lab. Environmental and Medical Science Div.). Aug 1988. 53p. H.M. Stationery Office, London, price Pound 12.00.

A transportable neutron spectrometry system of high sensitivity, based on four cylindrical proton-recoil proportional counters, has been developed for the high-resolution measurement of neutron spectra in the working environment at dose-equivalent rates in the range 5-50 μSv h/sup -1/. The system uses modern compact electronics to provide simultaneous data acquisition with a single multi-

channel analyser. This report describes in detail the research and development undertaken to produce a set of four cylindrical counters to cover the neutron energy-range from about 50 keV to 2 MeV. Counter studies were made to optimize the type and size of anode wire, the gas fillings and manufacturing procedure. The counters were calibrated at the National Physical Laboratory using monoenergetic neutrons, incident side-on and end-on, to provide measured response functions, energy and fluence calibrations. The system will generally be used together with a set of multispheres, to measure the dose-equivalent below 50 keV, and an α-recoil proportional counter to extend the spectral measurement up to 15 MeV.

3416 **(BNL—41913) Report on application specific integrated circuits for relativistic heavy ion detectors.** Platner, E.D. (Brookhaven National Lab., Upton, NY (USA)). 17 Aug 1988. Contract AC02-76CH00016. 4p. (CONF-880762—1). NTIS, PC A02/MF A01. Order Number DE89002938/JAW.

From Summer institute: school and workshop on heavy ion physics; Upton, NY, USA (11 Jul 1988).

Detector systems for RHIC experiments are invariably going to be large and complex. Thus it behooves the planners to incorporate elements that have little need for adjustment, calibration and correction to the produced data. For example, if power, size and cost considerations permit, time can be digitized directly (i.e. with counters, shift registers, etc.) where no adjustments, calibrations or corrections are required. The circuit either works correctly or not at all. This kind of circuit behavior is extremely valuable in detectors with 10^5 or more channel elements. In analog to digital conversion applications, direct conversion (i.e. flash ADC) may be prohibitive in cost, size and power. Here major effort must be given to minimize the magnitude of offset and conversion gain variance. Where possible self correction and adjustment should be applied at the subsystem level.

3417 **(CONF-881022—1) Development of an optical digital ionization chamber.** Turner, J.E.; Hunter, S.R.; Hamm, R.N.; Wright, H.A.; Hurst, G.S.; Gibson, W.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01. Order Number DE89002209/JAW.

From Workshop on implementation of dose equivalent meters based on microdosimetric techniques in radiation protection; Schloss Elmau, F.R. Germany (18 Oct 1988).

We are developing a new device for optically detecting and imaging the track of a charged particle in a gas. The electrons in the particle track are made to oscillate rapidly by the application of an external, short-duration, high-voltage, RF electric field. The excited electrons produce additional ionization and electronic excitation of the gas molecules in their immediate vicinity, leading to copious light emission (fluorescence) from the selected gas, allowing the location of the electrons along the track to be determined. Two digital cameras simultaneously scan the emitted light across two perpendicular planes outside the chamber containing gas. The information thus obtained for a given track can be used to infer relevant quantities for microdosimetry and dosimetry, e.g., energy deposited, LET, and track structure in the gas. The design of such a device now being constructed and methods of obtaining the dosimetric data from the digital output will be described. 4 refs., 4 figs.

3418 **(DOE/ER/40207—4) Streamer chamber and calorimeter measurements in relativistic heavy ion research: Final report.** Wolf, K.L. (Texas A and M Univ., College Station (USA). Research Foundation). 1 Oct 1988. Contract AS05-85ER40207. 35p. NTIS, PC A03/MF A01. Order Number DE89002864/JAW.

The goal of this project is to speed up the analysis of streamer chamber pictures by replacing a human scanner with a computer to the greatest extent possible. A large fraction of the software has been written and tested, the computer hardware has been ordered, and the first results from this analysis are reported below. These results are based on about 75 events which have been analyzed so far. A more complete analysis, including a larger number of events, will soon be available. These results are based on a semi-automatic analysis of the data. Those parts of the analysis which require intervention of a scanner continue to limit the rate at which pictures can be analyzed. The amount of scanner intervention will decrease as the project progresses, but it is not realistic to believe that the scanner will be completely eliminated. This section will give an overview of the existing and planned streamer chamber picture analysis system. Some portions of the analysis system will be described in detail in the following sections. 5 refs., 15 figs.

3419 **(FNAL/C—88/107) The monitoring of accelerator-produced muons at Fermilab.** Elwyn, A.J.; Cossairt, J.D.; Freeman, W.S. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1988. Contract AC02-76CH03000. 11p. (CONF-881232—9). NTIS, PC A03/MF A01. Order Number DE89001246/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The fluence of high-energy muons that result from the operation of the Tevatron accelerator was measured downstream of the experimental area beam lines. Profiles were determined by use of plastic scintillators and associated electronics mounted in a mobile laboratory at various locations on-site and at the site boundary. The experimental method and the properties of the fluence profiles are summarized, and in one case the measurements are compared to Monte Carlo calculations of muon transport. 6 refs., 11 figs., 1 tab.

3420 **(IFVE-OEF—83-1) Calculational characteristics for position-sensitive multianode photomultipliers.** Vasil'chenko, V.G.; Dyatchenko, V.A.; Rakhmatov, V.E.; Rykalin, V.I.; Ryabova, T.D.; Tsvetkova, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 14p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704771/JAW.

Submitted to the collection Vopr. At. Nauki i Tekhniki.

Design features and basic calculational characteristics of some new one- and two-dimensional position-sensitive photomultipliers are described. The photomultipliers permit to establish photosensitive surfaces of a large area. The calculations have shown the possibility to obtain spatial signal separation by +-2.5 mm higher, spatial resolution - +-0.6 mm, and time resolution - +-0.5 ns. 15 refs.; 6 figs.

3421 **(INFN-LNF—88-15(P)) Calculation of dose equivalent index, effective dose equivalent and ambient dose equivalent for the giant resonance neutron spectra produced at an electron accelerator.** Pelliccioni, M.; Zanini, A. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati; Istituto Nazionale di Fisica Nucleare, Turin (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE88704909/JAW.

Extended version of the paper presented at the 6.th Symposium on Neutron Dosimetry, Neuherberg (Germany, F.R.) 12-16 Oct 1987.

The ANISN code has been used in this study to evaluate the attenuation of neutron beams of various spectra incident normally on slabs of different kinds of concrete. Spectra of the most common sources (Am-Be and Cf-252) and those of giant resonance neutrons, produced at electron accelerators, were studied. The concretes examined had densities between 2.1 and 4.64 g.cm/sup -3/. The calculation were made in terms of the deep dose equivalent index, the effective dose equivalent and the ambient dose equivalent. Values of attenuation length in the various materials were derived from the attenuation curves. The results found should allow for useful evaluations in every day practice for health physicist.

3422 **(INIS-BR—1293) Determination by iterative regression of gaussian peaks in gamma spectra.** Nordemann, D.J.R. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704534/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

3423 **(INIS-BR—1323) Yeld variation of an X-ray equipment, in function of kilovolt, miliampere, exposure time, total filtration and distance focus-film.** Farias, J.T. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 24p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE88704914/JAW.

The standardization of operation techniques for an X-ray equipment are showed aiming at optimize the radiographic image and its reproduction, by an adjustment of several parameters such as tension, current, exposure time, total filtration and the distance of focus to film. (C.G.C.).

3424 **(INIS-BR—1329) Main tests for quality control in X-ray equipment of radiodiagnosis.** Ferreira, R.S. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 28p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704788/JAW.

All aspects of the relation between patient, examination and diagnosis for controling the quality in radiodiagnosis are showed. The bundle collimation for decreasing the scattered radiation in patient and the systems for measuring the exposure time are described. The yield valuation and the tension for X-rays tube are also cited. (C.G.C.).

3425 **(INIS-BR—1332) Parameters of X-ray equipment that influence in patient exposure.** Peixoto, J.E. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 9p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704791/JAW.

The main components of the X-rays equipment and the secondary device for radiodiagnosis examination are showed. The influence of all radiographs parameters in human exposure as tension and current are also analysed. (C.G.C.).

3426 **(INIS-BR—1333) Interaction between beans and objects.** Farias, J.T. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 12p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704792/JAW.

The interaction between the X-ray beans and objects are studied, with the modification in the intensity. The kilovolt, the bundle filtration, the structure and composition of the patient and the quantity of scattered radiation are also described, as the main parameters for the contrast and for the dose of the patient. (C.G.C.).

3427 **(INPE—4233) Gamma spectrometry of infinite 4PI geometry.** Nordemann, D.J.R. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1987. 24p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704804/JAW.

Owing to the weak absorption og gamma radiation by matter, gamma-ray spectrometry may be applied to samples of great volume. A very interesting case is that of the gamma-ray spectrometry applied with 4PI geometry around the detector on a sample assumed to be of infinite extension. The determination of suitable efficiencies allows this method to be quantitative.

3428 **(IPEN-Pub—139) Determination of transmission factors for beta radiation at different experimental conditions.** Albuquerque, M. da P.P.; Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jun 1988. 17p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704273/JAW.

During the transmission factors determination of beta radiation in air, using an ionization chamber with variable volume (extrapolation chamber), connected to a digital electrometer, and the secondary standard system constituted by the /sup 90/Sr + /sup 90/Y, /sup 204/Tl and /sup 147/Pm sources, the positioning of absorber materials equivalent to tissue, in relation to the detector and to the radiation sources is fundamental. In this work the absorbers were positioned in front of the sources, as well in front of the chamber, in different experiments, and the data were compared.

3429 **(IPEN-Pub—143) Simultaneos determination of absorbed doses due to beta and gamma radiations with CaSO/sub 4/: Dy produced at Ipen.** Campos, L.L.; Rosa, L.A.R. da. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 14p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704274/JAW.

Due to the Goiania radiological accident, it was necessary to develop urgently a dosimeter in order to evaluate, simultaneously, beta and gamma absorbed doses, due to /sup 137/Cs radiations. Therefore, the Dosimetric Material Production Laboratory of IPEN developed a simple, practical, light and low cost badge using small thickness (0,20mm) thermoluminescent CaSO/sub 4/: Dy pellets produced by the same laboratory. This pellets are adequate for beta radiation detection. These dosimeters were worn by some IPEN technicians who worked in Goiania city, and were used to evaluate the external and internal contaminations presented by the accident victims interned at the Hospital Naval Marcilio Dias.

3430 **(ITEF—8(1988)) Installation for 2β-decay search on the base of Ge(Li) detector enriched by /sup 76/Ge isotope.** Vasenko, A.A.; Vereshchagin, Yu.N.; Kirpichnikov, I.V. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 17p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704807/JAW.

Characteristics of the installation constructed in ITEP to search for binary β-decay in /sup 76/Ge-/sup 76/Se transition are described. Application of the semiconductor detector based on germanium enriched by /sup 76/Ge isotope up to 85% is a principal difference from another analogous installations. It increases germanium content in natural material, that provides proportional increase for the installation sensitivity. The installation consists of a ternary-crystal Ge(Li) detector, NaI(Tl)-active protection, passive protection based on tungsten, lead and boron polyethylene. Arrangement in the 245 m in depth well decreases the background cosmic component by three orders. The level of natural radioactivity in a salt well is also 20-40 times lower than on the Earth surface, that reduces requirements to passive protection. 13 refs.; 9 figs.

3431 **(ITEF—191(1987)) On-line test setup for mass-produced proportional chambers quality testing.** Burov, S.I.; Galaktionov, Yu.V.; Gordeev, A.M. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704819/JAW.

A hadron calorimeter appears to be one of the elements of L3 detector created for experiments in electron-positron LEP collider which is under construction in CERN. The calorimeter is of modular structure. It comprises 8000 proportional chambers interlaid by absorber plates and assembled into 144 modules. Depleted uranium is used as absorber. An on-line setup for wire proportional chamber channel testing is described. Application of "Elektronika-60M" computer for control of supply sources, switching units, meters for data acquisition and processing allows one to bring the setup efficiency to 2000 channels per day. The main failure reasons consist in the presence of mechanical defects on the surfaces of signal wires and tubes. 4 refs.; 9 figs.

3432 **(JINR—16-88-65) New type of high-energy neutron spectrometer for investigations in radiation protection physics and dosimetry.** Krylov, A.R.; Timoshenko, G.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of Radiation Safety). 1988. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704836/JAW.

Submitted to the journal Prib. Tekh. Ehksp. .

The device for measurements of high-energy neutron component characteristics in mixed scattered radiation fields behind the accelerator shield is described. The principle of the device is based on dependence of readings of neutron counter with plastic scintillator on high energy neutron differential flux density at various

thresholds of signal registration. The device consisting of neutron counter surrounded by veto scintillator fo charged particle rejection has a high sensitivity and can be used for measurements of fluxes, maximum equivalent doses and spectra of neutrons with energy above 20 MeV. The unfolding of neutron spectra basing on device data is performed by the statistical regularization method. The device construction, calibration, measurement methods and some preliminary results of neutron spectra unfolding behind the JINR accelerator shield are presented. 19 refs.; 6 figs.

3433 **(JINR—R-3-87-449) DIFRAN neutron spectrometer at the IBR-2 reactor. Design and parameters.** Aleksandrov, Yu.A.; Androsov, A.V.; Vrana, M. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704301/JAW.

The DIFRAN facility is produced at the IBR-2 pulsed reactor for investigation of neutron-optical phenomena at neutron diffraction on perfect crystals at simultaneous observation of several reflection orders. Favourable conditions for study of dynamic diffraction in a wide range of wave lengths and momentum transferred are created due to a specific feature of a neutron spectrum containing high intensity of epithermal neutrons. The main units of the facility are as follows: a two-crystal spectrometer located on a 25 m flight basis; a collimation system of the order of 10; goniometers for crystals (accuracy 1); a precise-rotational table (rotation pitch 0.1/sup "/ in 5/sup '/ range). The resolution of the facility at $\lambda >= 1$ A, $\delta\lambda/\lambda <= 1\%$; at $\lambda = 0.2$ A $\delta\lambda/\lambda = 10\%$. Diffraction spectra are measured in the angular range $2\theta = 8$ deg - 120 deg. The main parameters of the facility, incident spectrum, background conditions are presented. The results of measurements with some crystals are given as an illustration. 14 refs.; 11 figs.

3434 **(JINR-R—10-88-72) VME multi-purpose parallel interface.** Chernykh, E.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704877/JAW.

Submitted to the journal Prib. Tekh. Ehksp. .

The VME multi-purpose parallel interface module BME1.0 is designed. This is 16-bit parallel register capable to work as a master or slave during transmission of one data word between VMEbus and a device connected through the front panel connector. Possible applications are: a computer or any type of program source interface (ROM-based for example) connected with the help of computer standard or non-standard parallel I/O card and VMEbus interface for parallel I/O data devices (printer or others) Electric circuit is based on TTL MSI IC's. TTL-level signals are directed through RPM7-50 front panel connector. Double-sided PCB is used with dimensions 233.4x160 mm, front panel dimensions are 262x20 mm. The module has been tested in data acquisition system of the ALPHA-3C spectrometer. 8 refs.; 7 figs.; 1 tab.

3435 **(JINR-R—13-87-914) Data acquisition system in experiments on the VASILISA setup.** Andreev, A.N.; Bogdanov, D.D.; Gorshkov, V.A. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704878/JAW.

Data aquisition system in experiments on the VASILISA kinematic electromagnetic separator is presented. Electronic circuit of single-detector registration system designed on the base of CAMAC units and the SM-3 computer, as well as software permitting data registration, preliminary processing and recording with 300-500 event/s rate are described. 15 refs.; 1 fig.

3436 **(LA—11393-C) Neutron resonance radiography: Report of a workshop, Los Alamos, NM: July 27-29, 1987.** (Los Alamos National Lab., NM (USA)). Jul 1988. Contract W-7405-ENG-36. 175p. (CONF-8707124—). NTIS, PC A08/MF A01. Order Number DE89002094/JAW.

From Neutron resonance radiography workshop; Los Alamos, NM, USA (27 Jul 1987).

Neutron resonance radiography is a new technique with great potential for non-destructive analysis and testing. This technique has been under research and development in a number of major research laboratories for some time. Unlike thermal neutron radiography, which is primarily oriented towards imaging hydrogen and a number of other highly neutron-absorptive materials without necessarily distinguishing between them, neutron resonance radiography has the capability of uniquely identifying many kinds of chemical elements and their individual isotopes. It also has the potential for temperature imaging in materials containing heavy elements and for certain dynamic features such as stroboscopic imaging. Although neutron resonance radiography has not yet been taken up in a systematic way for technological applications, significant development of ideas and instrumentation at the research level has blossomed. There have also been major developments in the availability of powerful pulsed-neutron sources. In light of these developments, the Los Alamos Neutron Scattering Center sponsored a workshop with the general aims of reviewing scientific and technical progress, discussing and highlighting future developments, and stimulating interest in technological exploitation of the methods. In addition to the techniques and instrumentation required for the field, the applications of neutron resonance radiography in some of the following industrial and manufacturing areas were discussed: nuclear fuel assay; nuclear safeguards in general; aerospace development (aeroengine blade temperature, stroboscopic techniques); diagnostics; non-nuclear industry (especially metallurgy); temperature imaging; use of mobile pulsed-neutron sources; and practical use of major pulsed-neutron facilities.

3437 **(LA-UR—88-2669) A Sr-90/Y-90 field calibrator for performance testing of beta-gamma survey instruments.** Olsher, R.H.; Haynie, J.S. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-881232—4). NTIS, PC A03. Order Number DE88016327/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

ANSI and regulatory agency guidelines prescribe periodic performance tests for radiation protection instrumentation. Reference readings should be obtained for one point on each scale or decade normally used. A small and lightweight calibrator has been developed that facilitates field testing of beta-gamma survey instruments. The calibrator uses a 45 microcurie Sr-90/Y-90 beta source with a filter wheel to generate variable dose rates in the range from 4 to 400 mrad/hr. Thus, several ranges may be checked by dialing in appropriate filters. The design, use, and typical applications of the calibrator are described.

3438 **(LBL—24529) The application of position-sensitive phoswich detectors for low-mass fragment detection in an array environment.** Chan, Y.; Chavez, E.; Dacal, A.; Gazes, S.; Harmon, B.A.; Plagnol, E.; Pouliot, J.; Ortiz, M.E.; Stokstad, R.G. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 15p. (CONF-870410—41). NTIS, PC A03/MF A01. Order Number DE89002670/JAW.

From 193. national meeting of the American Chemical Society; Denver, CO, USA (5 Apr 1987).

Large solid angle position-sensitive phoswich detectors have been constructed to replace smaller units in an array for detecting medium mass fragments ($Z \leqq 15$) in nuclear experiments. The position information was obtained from a time analysis method. 5 refs., 9 figs.

3439 (LBL—24604, pp 21-46) **Calorimetry for a 4π-RHIC detector.** Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Two working groups, one centered at BNL and the other at CERN, have been studying RHIC-specific calorimetry issues relevant to a large 4π-general purpose RHIC detector. Topics covered included the required energy and position resolution, low energy response and calorimeter associated background as well as instrumentation of the detectors. These considerations led to a conceptual design, which was further developed during the Workshop. 19 references, 11 figures, 2 tables.

3440 (LBL—24604, pp 47-105) **Status of the RHIC dimuon detector.** Aronson, S.; Awes, T.; Braun-Munzinger, P.; Gorodetzky, P.; Gross, E.; Landaud, G.; Ludlam, T.; Murtagh, M.; Shor, A.; Stachel, J.; Young, G. Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

The main conclusion of the Dimuon Working Group is that dimuon physics deserves continued serious attention; theoretical progress and new detector ideas suggest that the main goals of dimuon physics at RHIC are, if anything, more accessible than before. In Section 2 recent theoretical input on the question of dilepton physics at RHIC is discussed. In Section 3 recent rate calculations in the mass regions of interest are presented. A new estimate of physics background rates is given in Section 4, together with some thoughts on methods to deal with this background. Punchthrough and decay backgrounds are reviewed in Section 5. In Section 6 a detector concept that is different in some respects from the one analyzed in Ref. 1.1 is shown. In Section 7 the acceptance and resolution are discussed. In Section 8 the interplay of the detector and machine are reviewed and recent calculations of luminosity vs. crossing angle are presented. Section 9 is a summary and recap of the questions that need to be addressed in detail, presumably in the course of proposing such a detector for RHIC. 16 references, 23 figures, 19 tables.

3441 (LBL—24604, pp 106-119) **Lepton pair spectroscopy for RHIC.** Glaessel, P.; Specht, H.J. (Universitaet Heidelberg (West Germany)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Continuum lepton pairs are among the most interesting signals to be studied in the search for a quark-gluon plasma in relativistic heavy ion collisions. In this paper the possibilities for electron pair spectroscopy at RHIC are discussed based on the insights gained in Monte Carlo simulations and design studies for an electron pair spectrometer for the CERN HELIOS experiment. In the first section, the main results of the Monte Carlo studies are reviewed on the principal feasibility of electron pair spectroscopy below masses of 1 GeV/c^2 in the presence of the unavoidable combinatorial pair background from π-Dalitz decays and γ-conversions. These studies have been performed both for the fixed target situation at the SPS and with special attention to RHIC. In the next sections, additional Monte Carlo results are presented on the combinatorial background using purely geometric cuts for the low mass pair rejection, on the background situation at masses above 1 GeV/c^2, and on the evaluation of inclusive electrons. Acceptances for geometries with partial azimuthal coverage, which could be of interest for general-purpose detector systems at RHIC, are also discussed. The following section contains the hardware concept of the HELIOS electron pair spectrometer and the line of reasoning which led to the choice of hadron blind tracking with two Ring Image Cherenkov (RICH) detectors. Some prototype results for these detectors are also given. In the final section, a direct adaptation of this concept to RHIC is proposed including some considerations on possible magnet configurations and overall performance limits. 10 references, 8 figures.

3442 (LBL—24604, pp 120-133) **Tracking for limited solid angles and the mid-rapidity hadron spectrometers.** Nagamiya, S. (Columbia Univ., New York, NY (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Tracking of charged particles, in particular multi-particle tracking, is not a trivial task. At RHIC the total multiplicity of charged particles in an event is expected to be on the order of 4000-8000 in the central Au + Au collision. On the other hand, the tracking of particles by electronic devices was, so far, successful up to multiplicity 10-20 but not more than that. Considering this fact, the tracking of a few hundred particles is already a very challenging task. As a first choice, therefore, the design of a spectrometer to cover the mid-rapidity region is focused on. This region is also interesting from the physics point of view, because rich physics related to quark-gluon plasma would mainly be expected there. Furthermore, the hadron detection, is focused on not only because this has been the main concern of the working group but also because it is in fact a very important element at RHIC. Designing the event trigger is important for the entire game. According to recent data from CERN and BNL, it seems that the total transverse energy (E/sub T/) is approximately proportional to the event multiplicity of charged particles (M/sub ch/). Since it is expected that high event multiplicities correspond to central collisions, the event trigger for high multiplicity or high transverse energy would be crucially important to select a central collision. In other words, a preparation of either calorimeter to measure E/sub T/ or multiplicity array to measure M/sub ch/ is important for any type of research at RHIC. It is assumed that such a device will be prepared in addition to the hadron spectrometer discussed in this article. The physics goals of hadron spectroscopy are reviewed. In particular, various constraints to the detector design from physics requirements are discussed. 8 references, 7 figures.

3443 (LBL—24604, pp 134-145) **Hadron spectroscopy group.** Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

In nuclear collisions at RHIC energies the formation of the quark-gluon plasma (QGP) is considered by some theorists to be the dominant reaction mechanism. Others do expect, however, the QGP to show up only in fluctuations. One has to prepare an experiment which can look for observables associated with the plasma. The following experimental concept was put forward to this group for study: (a) Full particle identification in absolute value of $y < 1$ for γ, e +/-, μ +/-, p, anti p based on tracking in a magnetic field with additional detectors for particle identification. (b) Full calorimetry - EM, as well as Hadronic - in absolute value of $y > 1$ with the capability of detecting and somehow measuring jets in the reaction. Tracking of approximately 2000 particles and more represents the major problem and is considered to be not trivial. A feasibility study is necessary and will be worked on by S. Nagamiya first in a finite solid angle of 1 sr containing approximately 300 particles. A new, radial drift chamber concept will be discussed here in this report and should be considered as a first try inviting full criticism. The calorimeter measurements at absolute value of $y > 1$ are following closely the plans detailed in the 4 π calorimeter group East and only a short discussion is dedicated to that part of the experiment. The following topics of the detector concept, are discussed: (a) magnet; (b) tracking at absolute value of $y < 1$; (c) particle identification; (d) calorimeters at midrapidity and in the fragmentation region; (e) multiplicity of charged particle measurement: absolute value of $y > 1$. 4 figures.

3444 (LBL—24604, pp 146-165) **Approximately 4π tracking magnetic spectrometer for RHIC.** Lindenbaum, S.J. Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—). Contract AC02-76CH00016;AC02-83ER40107.

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

A tracking magnetic spectrometer based on large Time Projection Chambers (TPC) is proposed to measure the momentum of charged particles emerging from the RHIC beam pipe at angles larger than 4° and to identify the particle type for those beyond 15° with momenta up to 700 Mev/c, which is a large fraction of the final charged particles emitted by a low rapidity quark-gluon plasma. This work is a variation of a device proposed at the first RHIC Workshop. 8 references, 6 figures.

3445 (LBL—24604, pp 166-168) **Some thoughts about experiments in the fragmentation region.** Braun-Munzinger, P.; Stachel, J. (State Univ. of New York, Stony Brook (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

The results of some discussions about possible experiments in the fragmentation region are presented. At RHIC energies one expects the baryon-rich regions to be within, say, 3 units of the beam rapidity, so that the fragmentation region is defined as absolute value of y > 3 or theta < 5.7°. Meanwhile the first results from experiments at the AGS and CERN have provided evidence that energy densities predicted to be necessary for plasma formation are already reached in fixed target experiments at energies where there is still substantial stopping. In such experiments the central region is baryon-rich and studies of it should yield information similar to what can be obtained from the fragmentation region at RHIC. In view of this new development the authors have tried to reassess the physics goals of an experiment covering the fragmentation region at RHIC. Some of the findings are listed below: (i) Quark gluon plasma formation in the fragmentation region should be strongly correlated with plasma formation in the central region. (ii) There are observables for plasma formation in the RHIC fragmentation region which might yield information different from that obtained by studies of the baryon-rich central region at CERN or AGS energies. (iii) There is clearly an interest in dedicated smaller set-ups to study specific observables in the fragmentation region. 3 references.

3446 (LBL—24604, pp 169-179) **GHEISHA simulation calculations of albedo.** Gavron, A. (Los Alamos National Lab., NM (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

The purpose of this note is to present some results of albedo calculations using the code GHEISHA version 6, of H. Fesefeldt, Aachen, FRG. Until confronted with experimental results, these results should be used to obtain order of magnitude of albedo effects only. Their purpose is to enable designers of detectors for RHIC and other facilities to estimate the effect of albedo from a Uranium/Scintillator calorimeter on other detectors. The calorimeter used in the simulation is comprised of alternating Uranium plates 93 mm. thick) and scintillator plates (also 3 mm. thick). The total depth of the calorimeter is 6.4 λ. The plates were circular with a radius of 1 meter. The beams (p,n,π-s) impinged perpendicular to the plates at the center of the circle. Calculations have been performed for beam kinetic energies of 0.2, 0.5, 2, 5, 20 and 50 GeV. For each of these energies they present detailed results for dE/dOmega and dN/dOmega (the total kinetic energy and particle multiplicity per unit solid angle) for albedo neutrons. There is a threshold of 5MeV, below which albedo neutrons are discarded. For albedo pions and protons, the albedo results are less accurate due to the very limited statistics of the Monte-Carlo simulation.

3447 (LBL—24604, pp 180-189) **Results at 10 GeV/nucleon from the E819 collaboration.** Wolf, K.L. (Texas A & M Univ., College Station (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Experiment E814 at the Brookhaven AGS covers a broad range of topics, as established by the title of the proposal Study of Extreme Peripheral Collisions and the transition from Peripheral to Central Collisions Induced by Relativistic Heavy Ions. The first beam time on the AGS used by the E814 collaboration has produced some interesting results. The primary purpose of the experiment was a test of detectors, but it became clear several months in advance that, in addition, a reasonable experiment could be performed. The experimental apparatus is relatively simple compared to the instrumentation of the other major heavy-ion groups. Transverse energy distributions taken with 10 GeV/nucleon Si on Al, Cu, and Pb targets are given. The shape of the transverse energy distributions is similar to the heavy-ion data taken at 200 GeV/nucleon, with a long plateau followed by a rapid fall off at high energies. This feature is interpreted as a pileup of the yield at high E/sub t/ for a relatively large range of central and near-central impact parameters. A more significant result can be seen if the multiplicative factor of 5 is taken out of the cross section for the lead target, which results in a complete overlap of the distributions for the lead and copper targets at the high energy end. Results for the aluminum target are significantly lower. At face value, these results argue strongly for complete stopping of 10 GeV/nucleon silicon, with the copper nucleus furnishing enough matter in central collisions to stop the projectile. 1 reference, 6 figures.

3448 (LBL—24604, pp 190-191) **Possible interaction vertex position detector.** Poskanzer, A.M. Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

A method to determine the position along the beam axis of the interaction vertex in a simple way, without tracking all the individual particles would be highly desirable. Because of the large interaction diamond in RHIC, a first guess at the interaction vertex would greatly help tracking and background reduction in an external spectrometer. Also, the information would be useful to determine when there are two interactions in the same beam crossing. A detector is being considered consisting of scintillating fibers bent into rings and flattened to disks resembling mechanical washers. Many of these scintillating washers would be placed around the beam pipe so that the planes of the washers are perpendicular to the beam axis. Individual lucite light pipes would conduct the light externally where a pulse height measurement would be made for each washer. The idea is that with thousands of particles each washer would integrate azimuthally and only preserve the lateral information along the beam axis. The idea of making the scintillating rings flat is to present a large thickness to the particles nearby coming perpendicular to the beam axis and a small thickness to the other particles, thus increasing the localization of the response of the detector. This effect is compensated by the fact that many more particles at smaller angles to the beam axis hit the washers, both because of the larger solid angle they present to the vertex and also because the particles pass through more than one washer. Thus a calculation is required. 1 figure.

3449 (LBL—24604, pp 192-209) **4π detector for the study of nucleus-nucleus collisions.** Rai, G.; Bieser, F.; Kleinfelder, S.A.; Odyniec, G.; Pugh, H.G.; Seidl, P.A.; Wieman, H. (Univ. of California, Berkeley (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

An outline is presented of a proposed 4π tracking detector to study collisions between relativistic heavy ions at the Bevalac and describe the development of a prototype time projection chamber. 7 references, 8 figures.

3450 (LBL—24604, pp 210-221) **Na36 Time Projection Chamber: an interim report on a TPC designed for a relativistic heavy ion experiment.** Diebold, G.E. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Since its conception in the early 1970s, the TPC has found application in several areas of particle physics ranging from e^+e^- collider experiments to rare decay studies of lepton nonconservation. A new and promising area of application for the TPC is the study of relativistic heavy ion collisions (RHIC). Presented here is an interim report on the first TPC for this field of physics, the NA36 TPC, being developed by Berkeley (LBL) for RHIC at the CERN SPS. Emphasis is placed on the operational and design considerations implemented to optimize the performance of the NA36 TPC in the study of central rapidity strange baryons produced in RHIC. The NA36 TPC volume is rectangular with an endcap area 0.5 m x 1.0 m and a maximum drift distance of 0.5 m. The drift

volume is filied with Ar-CH_4 (9%) at one atmosphere. A total of 6400 channels of time digitizing electronics instrument 66% of the endcap in a wedge shaped area matched to fixed target kinematics. 6 references, 5 figures.

3451 (LBL—24604, pp 226-242) **Computing issues for large detectors.** Loken, S.C. (Univ. of California, Berkeley (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

The computing issues which will affect planning for experiments at RHIC is reviewed. It is traditional in workshops on new facilities to discuss the computing requirements for the experiments. Usually this discussion will focus on the number of MIPS (Million Instructions Per Second) needed to analyze the data tapes and, perhaps, the number of Terabytes of data storage. These are important parameters for planning new facilities. They are, however, only two of the features that define the computing requirements for new experiments. In this paper, the author discusses a broader range of computing issues and indicates how the problems of large experiments might be addressed on the time-scale of RHIC. In this discussion, he draws on the experiences of high energy physics groups working at colliding beam facilities, especially the Tevatron and LEP. In the colliding beam experiments, it has become increasingly important to consider the computing system as a component of the full detector system. The computing system includes online and offline computers, workstations, networks and mass-storage. It also includes software, both commercial and experiment-specific. In the next section, he reviews recent developments in computing equipment as well as mass storage and networks. In the following section, he turns to the problems of software development, testing and maintenance.

3452 (LBL—24604, pp 243-250) **Comparison of existing and proposed HEP data acquisition systems and their suitability for RHIC.** Sunier, J.W. (Los Alamos National Lab., NM (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

In this note, a summary of these DACQ systems is presented for UA1, MARK II, D0, CDF, and SLD, focusing on the data acquisition stages and trigger rates. The suitabiiity of these systems for a RHIC calorimeter detector with ports is then discussed. Although these DACQ systems have their individuaiity, they all use the common approach, of a multi-level trigger that reduces the rate and volume of the data to be recorded, in a number of appropriate steps. The first level trigger is analog, operates in the 1 μsec range, and has the purpose to reduce the interaction rate to a manageable rate of 10^5 hz or less. While a second level trigger is being formed, in a time range as short as 10 μsec for SSC detectors, the data can be compressed (zero suppression, pedestal subtraction, etc.) and is buffered. The second level trigger has usually some intelligence, in the form of programmable logic or micro-processors. The third level trigger is done by software. At this stage, it is current practice to employ a processor farm to assemble full events and implement the reconstruction necessary to perform the final event selection, prior to archival on tape or optical disc. The nature and amount of data processing performed at each level is flexible and depends on the application. The differences between the specific systems described below reside in: interaction rate and raw event size, type of primary data acquisition hardware and read-out scheme, choice of busses and processor farms. 6 references, 4 figure.

3453 (LBL—25725) **Phonon detection with semiconductor thermistors.** Sadoulet, B. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 13p. (CONF-8805212—1). NTIS, PC A03/MF A01. Order Number DE89001256/JAW.

From 2. European workshop on low temperature devices; Annecy, France (2 May 1988).

We give a status report of the development effort that we have undertaken in Berkeley to detect ballistic phonons with Neutron Transmutation Doped Germanium thermistors. 22 refs., 4 figs.

3454 (NUREG/CR—5223) **Scintillation fiber detector for in-vivo endoscopic internal dosimetry.** Pettijohn, R.R. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Center for Planning and Research, Inc., Palo Alto, CA (USA)). Oct 1988. 33p. NTIS, PC A03/MF A01 - GPO. Order Number TI89002029/JAW.

This document reports on a feasibility study to design and construct a scintillation fiber radiation detector for in-vivo endoscopic internal dosimetry. The instrument design utilizes an alpha/beta particle-sensitive plastic scintillation fiber to detect and measure internally deposited radionuclides that cannot be suitably assayed using other techniques. Scintillations are optically guided to a photomultiplier for detection. The computerized electronics provides preamplification, amplification, analog-to-digital conversion and storage in a multi-channel analyzer. The microcomputer provides data storage, retrieval, and graphical display. Alpha detection and attenuation were conducted with a calibrated P_0-210 source. Ten scintillation fibers of varying diameters (0.5--3 mm) and properties were tested to determine their relative sensitivity for alpha particle detection as a function of distance of the source to the photomultiplier tube. The sensitivity in counts per minute was approximately proportional to the diameter of the fiber for samples of the same composition and manufacturer. 20 refs., 8 figs., 3 tabs.

3455 (PITHA—87-37) **Development of a chamber for temperature studies of counting gases.** Nau, G. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.; Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Jan 1988. 72p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755590/JAW.

The aim of the present thesis was the development of a drift chamber which makes a study of the drift velocity of electrons in dependence on the temperature of the applied counting gas possible. In a final test first measurements were performed. As gas mixture CO/sub 2/-iC/sub 4/H/sub 10/ in the ratio 80% - 20% was used which is distinguished by a low drift velocity as well as a low diffusion. It is therefore for the application in drift chambers especially well suited. At constant drift field E as well as constant gas pressure P (E/P = constant) the drift velocity increases linearly with the temperature of the applied counting gas. The absolute value of the change of the drift velocity increases proportionally to the applied drift field. The relative change of the drift velocity decreases with increasing drift field. This effect can be explained by the assumption that the drift electrons are no more on a thermal energy level. By plotting of the drift velocity over variable E/P (T = const.) a linear relation between both quantities is obtained. At constant density N of the counting gas and constant field strength E of the applied drift field (E/N = constant), the drift velocity doesn't change its value. Summarizingly it can be statet that the first measurement results confirm the theoretical predictions and the drift chamber yields over a time range of four months together consistent data. The studies should - especially in view of an explanation of the cause of this effect - be continued. For the reduction of the measurement error however some alterations in the experimental arrangement must be performed. (orig./HSI).

3456 (PITHA—87-38) **Test of a detection structure for a high-resolution vertex chamber. Determination of the spatial resolution in drift direction.** Dorsel, D. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.; Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Jan 1988. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755591/JAW.

For the LEP experiment L3 a possible chamber geometry for the vertex chamber was developed and tested. Two prototypes of realistic quantity were studied by means of high-energetic particle and laser beams, especially in view on the reachable spatial resolution and the occuring pulse shapes. The used analysis methods are briefly presented, and the obtained results are discussed. (orig./HSI).

3457 **(PITHA—87-39) Test of a detection structure for a high-resolution vertex chamber. Determination of the spatial resolution along the signal wire.** Gruenewald, M.W. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.; Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Jan 1988. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755592/JAW.

For the LEP experiment L3 a self-supporting detection structure in the TEC principle for the central vertex chamber was tested both with particles and with laser beams. The main topic of this thesis lied thereby on the determination of the coordinate of the particle passage along the signal-wire axis. Two different methods for the determination of this coordinate along the signal wire were studied. (orig./HSI).

3458 **(PNL-SA—16102) DOE personnel neutron dosimetry evaluation and upgrade program.** Faust, L.G.; Stroud, C.M.; Vallario, E.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 9p. (CONF-881032—4). NTIS, PC A02/MF A01. Order Number DE89002356/JAW.

From 2. conference on radiation protection and dosimetry; Orlando, FL, USA (31 Oct 1988).

The US Department of Energy (DOE) sponsors an extensive research program to improve the methods, dosimeters, and instruments available to DOE facilities for measuring neutron dose and assessing its effects on the work force. The Total Dose Meter was recently developed for measuring in real time the adsorbed dose of mixed neutron and gamma radiation and for calculating the dose equivalent. The Field Neutron Spectrometer was developed to provide a portable instrument for determining neutron spectra in the workplace for flux-to-dose equivalent conversion and quality factor calculation. The Combination Thermoluminescence/Track Etch Dosimeter (TLD/TED) was developed to extend the effective neutron energy range of the conventional TLDs to improve detection of fast-energy neutrons. An Optically Stimulated Luminescence Dosimeter is presently being developed for application to gamma, neutron, and beta radiation. An Effective Dose Equivalent System is being developed to provide guidance in implementing the January 1987 Presidential Directive to determine effective dose equivalent. Superheated Drop Detectors are being investigated for their potential as real time neutron dosimeters. This paper includes discussions of these improvements brought about by the DOE research program. 3 refs.

3459 **Calibration of a portable intrinsic Ge gamma-ray detector using point sources and testing for field applications.** Cutshall, N.H.; Larsen, I.L. (Oak Ridge National Lab., TN (USA)). *Health Physics;* **51**: No. 1, 53-59(Jul 1986).

A simple procedure using point sources is described for the calibration of portable high-resolution gamma-ray detectors used in field surveys. The point source data are fitted by empirical equations that are used to calculate efficiency for field applications. Two models for the distribution of radionuclides are treated: a thin surface-film model and a vertically homogeneous model. The success of the procedure has been demonstrated by field applications in plots where the levels of contamination are known.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 3320, 3354, 3524, 3624

3460 **(CONF-881232—3) Thin film techniques for developing a more rugged alpha scintillation detector.** McElhaney, S.A.; Chiles, M.M.; Bauer, M.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03. Order Number TI88016798/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The objective of this project was to develop an alpha scintillation detector more rugged than conventional detectors having aluminized Mylar entrance windows, which can be damaged in some hostile environments encountered in field surveys. A more durable, light- tight entrance window will reduce maintenance costs. This developmental model consists of a thin sandwich of scintillator, opaque material, and scuff-resistant coating deposited on a transparent substrate. Several scintillators have been evaluated for light output and high alpha-to-gamma ratio. After optimizing the thickness of the scintillator, the layer is made opaque to ambient light by coating the front side with a light-tight material such as aluminum. The opaque entrance window is protected with a scuff-resistant layer of silicon dioxide, and the finished wafer is attached to a photomultiplier tube to complete the detector assembly. 6 refs., 7 figs.

3461 **(DOE/WIPP—88-027) A shrouded aerosol sampling probe: Waste Isolation Pilot Plant.** McFarland, A.R.; Ortiz, C.A.; Moore, M.E.; DeOtte, R.E. Jr.; Somasundaram, S. (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.; Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering). Aug 1988. Contract AC04-86AL31950. 27p. NTIS, PC A03/MF A01. Order Number DE89002764/JAW.

A new device has been developed for sampling aerosol particles from moving air streams--a shrouded probe. In the design reported herein, a 30 mm diameter sampling probe is located concentrically within a 105 mm diameter cylindrically-shaped shroud. The flow rate through the sampling probe is a constant value of 170 l/min. The dynamic pressure of the external air stream forces flow through the region between the shroud and the internal probe. The velocity of the main air stream, U/sub o/, is reduced in the shroud such that the velocity just upstream of the probe, U/sub s/, is 0.40 that of U/sub o/. By reducing the main air stream velocity, the aerosol losses on the internal walls of the probe inlet are considerably reduced. For a typical isokinetic probe sampling at 170 l/min in an air stream with a velocity of 14 m/s, the wall losses of 10 μm aerodynamic diameter particles are 39% of the total aspirated aerosol; whereas, the wall losses in the shrouded probe are 13%. Also, by reducing the velocity of the air stream in the shroud, anisokinetic effects can be substantially reduced. Wind tunnel experiments with 10 μm diameter particles over the range of free stream velocities of 2.0 to 14 m/s show the transmission ratio (ratio of aerosol transmitted through the probe to aerosol concentration in the free stream) to be within the range of 0.93 to 1.11. These data are for a constant flow rate of 170 l/min through the probe. 19 refs., 7 figs.

3462 **(EGG—10617-5008) LAREDO streak camera project: Final report.** Anaya, R. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract AC08-88NV10617. 7p. NTIS, PC A03/MF A01. Order Number DE89002483/JAW.

This report describes the work performed on the streak camera experiment fielded on LAREDO by EG&G Energy Measurements, Los Alamos Operations (LAO) in support and under the direction of group P-14 of the Los Alamos National Laboratory. It is intended to cover only those hardware aspects of the project for which LAO had responsibility, but references are made to components and support provided by the Santa Barbara Operations and the Las Vegas Support Operations of Energy Measurements. This report covers the five RTC streak camera systems EG&G/EM, Los Alamos Operations fielded for P-14 on LAREDO. These cameras were designated streak camera systems 1 through 5. Systems 1, 2 and 3 were configured to record optical signals generated by microballoons. Systems 4 and 5 utilized prism spectrometers to record the optical signals, which were expected to be similar to a black body spectrum. A new prism spectrometer was developed to provide improved spectral resolution. 3 figs.

3463 **(IC—88/68) Semiconductor laser shearing interferometer.** Ming Hai; Li Ming; Chen Nong; Xie Jiaping. (International Centre for Theoretical Physics, Trieste (Italy); University of Science and Technology of China, Hefei (China). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704695/JAW.

The application of semiconductor laser on grating shearing interferometry is studied experimentally in the present paper. The

method measuring the coherence of semiconductor laser beam by ion etching double frequency grating is proposed. The experimental result of lens aberration with semiconductor laser shearing interferometer is given. Talbot shearing interferometry of semiconductor laser is also described. (author). 2 refs, 9 figs.

3464 **(JINR-R—10-88-9) Densitometric calibration of the CRT scanning devices.** Lapchik, Eh.D.; Senchenko, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1988. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704876/JAW.

Submitted to the journal Avtometriya.

The procedure and results of densitometric calibration of the AEhLT-2/160 scanning device are considered. The calibration was put into practice by virtue of the standard stepped webge in the densitometric devices. Moreover, the compensation of the spatial amplitude distortions has been ensured, and the considerable increase of measured optical density band with a rather high measuring quality have been achieved. The possibility of the scanning device usage as a computer-controlled densitometer is shown. The application of the densitometric calibration allows to increase the devices ability in the semitone stereoimage processing. 9 refs.; 6 figs.

3465 **(LA-UR—88-3372) MENU: A FORTH menu compiler.** Butterfield, K.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-881197—1). NTIS, PC A02/MF A01. Order Number DE89002289/JAW.

From 10. annual FORML conference; Pacific Grove, CA, USA (25 Nov 1988).

Menu-driven command interpreters are an effective means of controlling portable instrumentation where input may be limited to a hex keypad and output to a few lines on a liquid crystal display. The MENU compiler uses the name fields from the words comprising the menu options as prompt strings. It produces compact program code, thus conserving memory that is often limited in ROM-based systems. Input for menu function selection is vectored to allow switching between input sources. The host system consists of the eight-bit Motorola M68HC11 processor and Max-FORTH (FORTH-83).

3466 **(N—88-27798) Synopsis of a computer program designed to interface a personal computer with the fast data acquisition system of a time-of-flight mass spectrometer.** Bechtel, R.D.; Mateos, M.A.; Lincoln, K.A. (Eloret Corp., Sunnyvale, CA (USA)). Mar 1988. 51p. (NASA-CR—177474; NAS—1.26:177474). NTIS, PC A04/MF A01.

Briefly described are the essential features of a computer program designed to interface a personal computer with the fast, digital data acquisition system of a time-of-flight mass spectrometer. The instrumentation was developed to provide a time-resolved analysis of individual vapor pulses produced by the incidence of a pulsed laser beam on an ablative material. The high repetition rate spectrometer coupled to a fast transient recorder captures complete mass spectra every 20 to 35 microsecs, thereby providing the time resolution needed for the study of this sort of transient event. The program enables the computer to record the large amount of data generated by the system in short time intervals, and it provides the operator the immediate option of presenting the spectral data in several different formats. Furthermore, the system does this with a high degree of automation, including the tasks of mass labeling the spectra and logging pertinent instrumental parameters.

3467 **(PB—88-247788/XAB) Dosimetry for non-ionizing radiation.** Fanslow, G.E. (Iowa State Univ. of Science and Technology, Ames (USA). Engineering Research Inst.). Mar 1981. 32p. (ISU-ERI-AMES—81171). NTIS, PC A03/MF A01.

Several commercially available phosphor-teflon dosimeters were subjected to thermal fade studies. The thermoluminescence dosimetry (TLD) tags were washed and air dried prior to each ionizing radiation pretreatment. Readings made over 3 weeks on the CaF2:Mn and CaF2:Dy TLD tags did not produce measurable thermal-fade characteristics for the 22 to 31°C temperature range. Nonionizing radiation treatments were at 2.45 GHz. While the results obtained did demonstrate decreases in signal levels over time and temperature changes, the patterns were not smooth, making it impossible to establish differences in TLD readings as quantitative measures of temperature differences which could serve as measures of long-term exposures to nonionizing radiation. The authors concluded that, due to the irregularities that existed in the thermal fade characteristics, the dosimeter would not be suitable for quantifying exposures to nonionizing radiation. There was significant potential in the device, however, as an indicator of radiation leakage or exposure.

3468 **(PB—88-869771/XAB) Detector and sensor devices: fabrication from lead compounds. January 1975-September 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 119p. NTIS PC N01/MF N01.

Supersedes PB—87-862587.

This bibliography contains citations concerning developments, properties, and production of lead compound materials for use in detector- and sensor-device fabrication. Topics include infrared detectors, lead compound heterojunctions and photodiodes, photovoltaic and pyroelectric detectors, epitaxial growth methods, remote sensing, and night vision. Development and preparation of lead sulfide, selenide, telluride, and thallium-monoxide compounds are discussed. Performance analysis and applications of lead compound detectors and sensors are examined. (This updated bibliography contains 229 citations, 19 of which are new entries to the previous edition.)

3469 **(UCID—21538) LLNL internal gas proportional counters.** Bonner, N.A.; Finkel, R.C. (Lawrence Livermore National Lab., CA (USA)). 15 Oct 1988. Contract W-7405-ENG-48. 13p. NTIS, PC A03/MF A01. Order Number DE89002854/JAW.

Several years ago it became clear that the old internal gas proportional counters used by the Nuclear Chemistry Group (LOBACA counters{endash}LOw bAckground Counting Assembly) were deteriorating. The plateaus were poor. The count rates drifted with time because the counters leaked. They had a memory for previously counted samples. The basic design and dimensions were satisfactory, but the construction could be improved. Therefore, we decided, to build a new set of counters of the same size, but with different materials. The new counters would be made of stainless steel with no plastic or rubber parts. This paper discusses these improvements.

3470 (UCRL—53868-87, pp 6.6-6.11) **Capacitance gauges for contour measurement.** Schenz, R.F.; Patterson, S.R. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have developed a low-noise differential-capacitance gauge suitable for use as a non-contact contour-measurement transducer. The sensitivity of the gauge is independent of both the active area of the capacitor and the capacity of the cable connecting the probe to the gauge electronics. The authors have demonstrated noise levels as low as 5.8×10^{-13} m/$\sqrt{\text{Hz}}$. A methodology that they have developed for measuring contoured surfaces with the gauge has provided accurate results when applied to a test object.

3471 (UCRL—53868-87, pp 6.16-6.18) **Characterization of X-ray optics by soft X-ray diffractometry.** Biltoft, P.J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have constructed a soft x-ray diffractometer to characterize layered synthetic microstructures (LSMs). The source, sample stage, and counter sections of the diffractometer operate under vacuum. The design differs from most others in two respects: the preamplifier and amplifier that process pulses from the subat-

mospheric-pressure gas-flow proportional counter are located outside the vacuum chamber and are separated from the proportional counter by approximately 76 cm of shielded cable; in addition, the conventional gear-driven, theta-two-theta diffractometer motion is accomplished with synchronized stepper motors. Characterizations of several LSMs have yielded data on d-spacing (distance between layers of different composition), critical angle, and peak reflectivity. Future work includes incorporation of an improved laser alignment system, in vacuo sample articulation (in addition to the theta-two-theta diffractometer movements), and a higher-flux photon source with a close-coupled fluorescent target carousel. Such a capability will permit multiple-energy diffraction work in a single pumpdown cycle.

3472 **(UCRL—98505) A photon-counting, subnanosecond, imaging camera for x-ray detection.** Carter, M.R.; Price, D.F.; Stewart, R.E.; Whelan, D.A. (Lawrence Livermore National Lab., CA (USA)). 9 Sep 1988. Contract W-7405-ENG-48. 8p. (CONF-8809105—9). NTIS, PC A02/MF A01. Order Number DE89002874/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

We have developed a high-bandwidth, photon-counting, x-ray detector for x-ray imaging experiments. It consists of an x-ray photocathode, an optional microchannel plate (MCP), optional electrostatic optics, and a subnanosecond phosphor. The detector can be used for two-dimensional imaging with a subnanosecond framing camera or one-dimensional imaging with a Reticon or streak-camera readout. Several versions of the one-dimensional detector have been developed. The MCP version employs a photocathode on the front surface of the MCP, and the transmission-photocathode version consists of a photocathode deposited on a thin polypropylene foil. The output electrons from the MCP or the transmission photocathode are accelerated into a fast phosphor deposited on a coherent fiber-optic faceplate. Both detectors can be enhanced with the use of electrostatic electron optics to compress the output electrons in one dimension. The best parameters achieved to date are a time resolution of 400 ps, spatial resolution of 100 μm, and electron compression of 10:1. Quantum efficiencies of 40% have been achieved. Effective quantum efficiencies greater than 100% have been achieved with the one-dimensional electrostatic optics. Data are presented on the efficiency, time response, at spatial resolution of the one-dimensional detectors. 5 refs., 9 figs.

3473 **(UCRL—99880) Image reconstruction using the bispectrum.** Lawrence, T.; Fitch, P.; Goodman, D. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 6p. (CONF-8810202—3). NTIS, PC A02/MF A01. Order Number DE89002933/JAW.

From 22. Asilomar conference on signals, systems and computers; Pacific Grove, CA, USA (30 Oct 1988).

The resolution of a standard telescope imaging system is severely limited by temperature-gradient induced phase fluctuations in the atmosphere. Short exposure images, however, during which the atmosphere is effectively frozen, contain diffraction-limited resolution information about the object. Techniques for extracting this information are collectively called "speckle interferometry". We will show that by averaging the complex bispectra of an ensemble of images, the Fourier phase of the object can be estimated. This estimate, combined with a standard estimate of the Fourier magnitude using the average power spectrum, will then yield a diffraction-limited reconstruction of the object. We also present results of a simulation of this technique, which demonstrates the reconstruction of an extended, noisy object from a series of short exposure images. 5 refs., 2 figs.

45 EXPLOSIONS AND EXPLOSIVES

REFER ALSO TO CITATION(S) 3678

4502 Nuclear

REFER ALSO TO CITATION(S) 3050, 3307

3474 **(AD-A—195846/1/XAB) Submillimeter-wavelength space-based imaging radar. Interim report.** Manheimer, W.M. (Naval Research Lab., Washington, DC (USA)). 31 May 1988. 26p. (NRL—9111). NTIS, PC A03/MF A01.

This report considers the use of a submillimeter wavelength space-based imaging radar. The main application envisioned is midcourse decoy discrimination for strategic defense, for which it would have the capability of producing a series of images, in real time, at strategic ranges, with less than meter-scale resolution and with modest power requirements. Undoubtedly, there are other applications. The requirements for a SAR and ISAR imaging radar at submillimeter wavelength are determined, and the prospect for the development of rf sources to power the radar is examined.

3475 **(AD-A—195905/5/XAB) Aerial T1 EMP (electromagnetic pulse) effects assessment. Volume 1. Final report.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). 15 May 1987. 69p. (BAH—1331-87-007I-VOL-1). NTIS, PC A04/MF A01.

The Office of the Manager, National Communications System (OMNCS) has undertaken the Electromagnetic Pulse (EMP) Mitigation program to support the survivability objectives addressed by National Security Decision Directive 97 (NSDD-97) and Executive Order 12472. The objective of this program is to mitigate the damaging effects of nuclear weapons on regional and national telecommunications capabilities. To meet this objective, the OMNCS has sponsored efforts to create a network-level model to assess the effects of high-altitude EMP (HEMP). In addition, the OMNCS has sponsored various efforts to collect the system-level HEMP effects data required to support the network-level model. The products of this model assist the NCS in identifying potential vulnerabilities of national telecommunications capabilities to HEMP and supporting National Security and Emergency Preparedness (NSEP) initiatives. This report presents an assessment of the survivability of aerial T1 systems in a HEMP environment. This effort includes a test program to collect the data required to assess coupling of incident electromagnetic fields to aerial T1 cables. Also this report documents the test activities and the data collected. It also reviews the results of the buried T1 system assessment and summarizes the relevant data. Based on these data, conclusions are drawn concerning the survivability of typical aerial T1 cable systems. Finally, recommendations are presented for addressing remaining issues relevant to this assessment.

3476 **(AD-A—196701/7/XAB) Study of target-enhancement algorithms to counter the hostile nuclear environment. Master's thesis.** Wright, C.H. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). May 1988. 104p. (AFIT/CI/NR—88-98). NTIS, PC A06/MF A01.

A necessary requirement of strategic defense is the detection of incoming nuclear warheads in an environment that may include nuclear detonations of undetected or missed-target warheads. A computer model is described that simulates incoming warheads as distant endoatmospheric targets. A model of the expected electromagnetic noise present in a nuclear environment is developed using estimates of the probability distributions. Predicted atmospheric effects are also included. Various image enhancement algorithms, both linear and nonlinear, are discussed concerning their anticipated ability to suppress the noise and atmospheric effects of the nuclear environment. These algorithms are then tested, using the combined target and noise models, and evaluated in terms of the stated figures of merit.

3477 **(AD-A—196801/5/XAB) DOD TNF (Theater Nuclear Forces) S3 (survivability, security, and safety) threat handbook. Final report, 1 December 1979-28 November 1980.** Klein, R.G.; Potter, C.J.; Semrad, J.A.; Willard, S.R.; Williams, G.V. (BDM Corp., Vienna, VA (USA)). 28 Nov 1980. 66p. (BDM/W—80-417-TR). NTIS, PC A04/MF A01.

Sanitized version.

This handbook was designed to identify the elements of the NATO Theater Nuclear Force structure and the corresponding threat assets of the Soviet/Warsaw pact forces. The document is intended to serve as a basic reference book for government and contract personnel participating in the DoD TNF S3 Program. The first three sections describe the NATO TNF assets and Soviet/Warsaw Pact threats; the final sections provide three employment scenarios: no warning, short warning, and moderate warning.

3478 **(AD-A—196803/1/XAB) Integrated nuclear considerations. Briefing - overview of nuclear planning and execution in European central battle. Final report, 1 April-19 May 1980.** Smiley, H.H.; Theroux, G.L. (JAYCOR, Alexandria, VA (USA)). 4 Dec 1980. 33p. NTIS, PC A03/MF A01.

Sanitized version.; Availability: Document partially illegible.

This briefing demonstrates the general thought process of a nuclear planner in Europe, both in the planning and execution phases of applying nuclear weapons against first-echelon regiments of a threat division in the breakthrough posture.

3479 **(AD-A—196804/9/XAB) New technologies and the role of nuclear weapons in national-security strategy. Volume 8. S3 (safety, security, and survivability) concerns and primitive nuclear powers. A concept paper. Technical report.** Brody, R. (R and D Associates, Marina del Rey, CA (USA)). 1 Dec 1983. 28p. (RDA-PH—83-11-00006M1-83H). NTIS, PC A03/MF A01.

Sanitized version. See also Volume 7, AD-A179 933.

This paper attempts an initial look at the potential roles of Safety, Security, and Survivability (S3) concerns in the design of the nuclear stockpiles of nascent nuclear powers. It address such issues as the influence of S3 concerns on a country's weapons design, its weapons-control system, its incentives to seek nuclear weapons in the first place, and the risks of proliferation for regional conflict and outside powers (including the United States). It also examines the implications of all of these factors for U.S. policy, especially the possibility of aiding or otherwise encouraging nascent nuclear powers to improve the S3 of their weapons. Improving S3 is particularly important in light of the strongly voiced belief that if we must have further proliferation, let each new arsenal contain as few and as primitive nuclear systems as possible. This argument has obvious superficial attractions--a weak primitive nuclear force would seem to have less potential for doing damage. On the other hand, a weak force may lead to a fragile, unstable, accident-prone arsenal and heighten the risk of regional nuclear war. Thus, some suggest actually aiding nascent atomic powers to develop more sophisticated safety and security systems for their weapons. (JHD)

3480 **(AD-A—196838/7/XAB) Transient interaction of electromagnetic pulses in dielectrics and microwave biophysics. Final report, 1 June 1985-30 May 1988.** Guo, T.C.; Guo, W.W. (Catholic Univ. of America, Washington, DC. Dept. of Physics). 12 May 1988. 70p. (—5-88-WRAIR/ONR). NTIS, PC A04/MF A01.

Due to recent progress in developing equipments that can generate short microwave and millimeter-wave pulses, there has been an increasing proliferation of microwave pulse transmitters, some with short pulse width (0.1 microsecond) and extremely high intensity (100-1000 megawatts). Microwave pulse transmitters are used extensively by the military for communication and remote control; using microwave pulses as directive energy weaponary and as means of transporting energy has also been contemplated. Electromagnetic pulses (EMP) are also emitted in nuclear blasts and from EMP simulators. All this production of microwave pulses affects the operation of military personnel in non-combat environment as well as in battle fields. Therefore minimizing microwave damage is central to successful operations of all military units. Understanding basic interactions between microwave pulses and dielectric materials will contribute greatly to the protection of human subjects from microwave damage and to the development of preventive measure.

3481 **(AD-A—196914/6/XAB) Effects of high-altitude electromagnetic pulse (HEMP) on telecommunications assets. Volume 1. Final report.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). 15 May 1987. 100p. (BAH—1331-87-008I). NTIS, PC A05/MF A01.

In response to Executive Order (E.O.) 12472 and National Security Decision Directive 97 (NSDD-97), the Office of the Manager, National Communications System (OMNCS) has begun an ElectroMagnetic Pulse (EMP) mitigation program. The objective of this program is the removal of EMP as a significant impediment to timely reestablishment of regional and national telecommunications following an attack against the United States that includes high-altitude nuclear detonations. The methodology for developing an EMP mitigation program plan was described in the National Communications System (NCS) report Electromagnetic Pulse Mitigation Program Approach of July 1982. The program approach involves estimating the effects of High-altitude EMP (HEMP) on telecommunications capabilities, assessing the impact of available HEMP mitigation alternatives, and developing a comprehensive plan for implementing mitigation alternatives. The purpose of this report is to summarize available test results as they apply to the EMP mitigation program.

3482 **(UCID—21485) Relationship between tritium production and stockpile requirements.** Civiak, R.L. (Lawrence Livermore National Lab., CA (USA)). 5 Aug 1988. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01. Order Number DE89002858/JAW.

In assessing tritium production and its relationship to the nation's warhead stockpile requirement, it has been found that large increases of tritium production are needed to achieve modest increases in the stockpile. It has also been found that tritium production needs can be reduced significantly by decreasing the process time required to revitalize decayed tritium. 5 figs.

3483 (UCRL—53868-87, pp 1.7-1.17) **Development of centrifuge modeling for evaluating the mechanisms of collapse above underground openings.** Davis, B.C.; Kutter, B.L.; Chang, J.D.L. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

Improved prediction of surface collapse above an underground cavity is important in many LLNL programs, including Nuclear Test. To improve the predictive capability, LLNL must better understand the mechanisms involved in the process of collapse. The research aims to develop the centrifuge technique for modeling mechanisms of underground collapse in soil. The authors will also evaluate the adequacy of existing constitutive or flow models of soils for modeling underground collapse. During FY 86, using the centrifuge at University of California, Davis, the authors developed the basic centrifugal modeling technique, conducted experiments, and modeled the process on a computer. In FY 87, they continued to develop the experimental method and analyze results. Results to date have shown that the model dimensions are not necessarily the critical dimensions (i.e., those determining the adequacy of the model). Rather, the critical dimension is the diameter of the chimney above the opening that develops during collapse.

3484 (UCRL—53868-87, pp 10.12-10.15) **Methods of seismic tomography for strongly inhomogeneous environments.** Berryman, J.G.; Zucca, J.J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have developed a new algorithm for inverting travel time data in media with strong ray bending. The results of this work will help to characterize sites for underground nuclear explosions and high-level waste disposal. The algorithm is based on the observation that Fermat's principle allows all of the trial rays

being considered at any stage of reconstruction to be classified as one of two types: (1) nonfeasible rays - those rays with travel times shorter than the travel times measured, or (2) feasible rays - those rays with travel times as long as or longer than the travel times measured. The authors apply two different sets of corrections to the two types of rays: one that increases the wave slowness along nonfeasible ray paths and another that uses Fermat's principle to alter all feasible ray paths in order to find the paths with the shortest travel time. This algorithm can be applied to almost any least-squares travel time inversion problem.

3485 **(UCRL—99900) Modeling flux compression generators with a 2D ALE [Arbitrary Lagrangian Eulerian] code.** Tipton, R. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 25p. (CONF-881093—10). NTIS, PC A03/MF A01. Order Number DE89002935/JAW.

From Nuclear explosives code developer's conference; Boulder, CO, USA (11 Oct 1988).

A 2D MHD ALE (Arbitrary Lagrangian Eulerian) code has been developed to aid in the design and understanding of magnetic flux compression generators. The hydro treatment is Lagrangian ahead of the armature-stator contact point and Eulerian behind. The code tracks the location of the high explosive detonation front and deposits the chemical energy behind it. Realistic equations of state are used for the detonation products, armature and stator. Strength of material effects for the armature and stator are included. The magnetic diffusion equations are solved implicitly and the magnetic forces are included in the hydrodynamic equations. The code has been used to model the performance of a coaxial flux compression generator designed at LANL as well as a continuously variable pitch, continuously variable conductor diameter helical generator designed at LLNL. Calculated results for each generator are presented and in the case of the coaxial generator, compared with data. The limitations of the code are discussed. 8 refs., 16 figs.

4503 Explosion Detection

3486 **(LA-UR—88-3487) Instrumentation and control developments in the Los Alamos nuclear test program.** Perea, J.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8810221—1). NTIS, PC A02/MF A01. Order Number DE89002122/JAW.

From 12. MAES national symposium on engineering and science; Los Angeles, CA, USA (19 Oct 1988).

The United States Department of Energy contracts the Los Alamos National Laboratory to carry out a Nuclear Weapons Test Program in support of the national defense. The program is one of ongoing research to design, build, and test prototype nuclear devices. The goal is to determine what should ultimately be incorporated into the nation's nuclear defense stockpile. All nuclear tests are conducted underground at the Nevada Test Site (NTS). This paper describes the instrumentation and control techniques used by Los Alamos to carry out the tests. Specifically, the contrast between historical methods and new, computer-based technology are discussed. Previous techniques required large numbers of expensive, heavy hardwire cables extending from the surface to the diagnostics rack at the bottom of the vertical shaft. These cables, which provided singular control/monitor functions, have been replaced by a few optical fibers and power cables. This significant savings has been enabled through the adaptation of industrial process control technology using programmable computer control and distributed input/output. Finally, an ongoing process of developing and applying the most suitable instrumentation and control technology to the unique requirements of the Test Program is discussed. 2 refs.

3487 (UCRL—53868-87, pp 10.16-10.18) **Statistical analysis of the yields of nuclear weapons tests.** Axelrod, M.C. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The author has investigated how accurately the yields of US underground nuclear weapons tests have been measured and predicted. Using the method of maximum likelihood estimation, he determined the yield prediction errors for the most commonly used measurement schemes. The analysis shows that radiochemical measurements of yields have been accurate to within about 5% (assuming zero bias). Apparently, this effort marks the first systematic analysis of the accuracy of yield predictions.

3488 (UCRL—53868-87, pp 10.23-10.26) **Designing sensor arrays for use with modern high-resolution methods.** Dowla, F.U. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The array design problem is important because of the widespread use of arrays in radar, sonar, acoustics, and seismic applications. This is particularly true of the research being done in seismic monitoring for verification of nuclear test bans. Conventional methods of designing planar seismic arrays rely primarily on the beam pattern calculated for the array. However, the beam pattern is not an adequate basis for designing arrays to be used with high-resolution multidimensional spectral estimation methods. Such arrays must be designed on the basis of the characteristics of not only the beam pattern but also the wave fields to be recorded for analysis. The author has studied the characteristics of seismic wave fields in the context of high-resolution array processing methods and have developed a procedure for designing arrays for these modern nonlinear algorithms.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

3489 **(IC—88/146) Physical and theoretical basis of solar-terrestrial relationships 1. Equatorial locations.** Njau, E.C. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704705/JAW.

The theory of solar-terrestrial relationships developed earlier by the author is extended to incorporate expressions that represent the non-linear responses of the earth-atmosphere system to incoming solar radiation in a more detailed manner. Application of the extended theory to equatorial locations leads to new and interesting features that are consistent with past observations. It also predicts the existence of new oscillations in the equatorial atmosphere whose causative physical processes are given and explained. Non-equatorial locations are treated along similar lines in Part 2 of the series. (author). 44 refs.

3490 **(IC—88/147) Physical and theoretical basis of solar-terrestrial relationships 2. Non-equatorial locations.** Njau, E.C. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704706/JAW.

The basic formulations presented in Part 1 of this series (hereinafter simply referred to as "Paper 1") are modified in order to mathematically represent the expected solar-terrestrial influences in non-equatorial regions. Analysis and interpretation of these formulations lead to the establishment of several new periodicities as well as other features associated with the non-equatorial atmosphere. Besides, we show through suitable examples that the physical processes that cause and influence some previously observed climatic and upper atmospheric variations in temperate and polar regions are easily deduced from our formulations. (author). 35 refs.

3491 **(IC—88/155) Generalized theory of sun-climate/weather link and climatic change.** Njau, E.C. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704712/JAW.

We generalize the theory of Sun-Climate/weather links and climatic change developed earlier by the author. On the basis of this theory, we show mathematically that key climatic/weather parameters are continuously subjected to determinable amplitude modulations and other variations which may be useful in climatic prediction work. A number of new and known terrestrial oscillations in climate and atmospheric behaviour in general, including the known quasi-biennial oscillations and many others, are deduced

from the theory and accounted for in terms of their causative physical processes. Finally we briefly discuss the possibility of applying the theory to the planets Mars and Venus as well as Saturn's largest satellite, Titan. (author). 30 refs, 1 fig.

5001 Basic Studies

REFER ALSO TO CITATION(S) 3567

3492 (AD-A—196298/4/XAB) Energy budget and ground temperatures in hot regions. Technical report for period ending February 1988. Stewart, D.A. (Army Missile Command, Redstone Arsenal, AL (USA). Research Directorate). Jun 1988. 44p. (AMSMI/TR-RD-RE—88-1). NTIS, PC A03/MF A01.

This report discusses characteristics of the atmospheric energy balance that contribute to the production of high surface-air temperatures and high ground temperatures. This discussion is followed by climatological information. The hottest regions are in northwestern Africa, the Arabian Peninsula, part of Pakistan, and a small part of the southwestern United States.

3493 (AD-A—196540/9/XAB) Origin of tropospheric ozone over central United States. Master's thesis. McNamara, D.P. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 121p. (AFIT/CI/NR—88-25). NTIS, PC A06/MF A01.

Ozone (O_3) is a key species in the troposphere for several reasons. It is a key ingredient of Los Angeles-type smog as a result of photochemical reactions. Tropospheric O_3 also impacts the radiation budget and may cause climate change because it is a greenhouse gas with a strong absorption band centered at 9.6 um in the atmospheric-window region (Fisherman et. al., 1979). Also, photolysis of O_3 by radiation of wavelengths less than 318 nm is the primary source of hydroxyl (OH) radicals in the troposphere. Sources of tropospheric O_3 have been under much debate in the past few days. O_3 is known to be photochemically active in the stratosphere where it strongly absorbs ultraviolet radiation, causing the reversal in lapse rate there.

3494 (UCID—21557) Thermal energy transport in CCM1 [Community Climate Model, Version 1]. Covey, C. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 12p. NTIS, PC A03/MF A01. Order Number DE89002821/JAW.

Understanding the manner in which the atmosphere transports heat from the warm equatorial regions to cooler high latitudes is fundamental to climate studies. In this report the author outlines a method of assessing such transport from the "data" produced by an atmospheric general circulation model, the National Center for Atmospheric Research (NCAR) Community Climate Model, Version 1 (CCM1), and results are shown for a brief CCM1 climate simulation run under perpetual January conditions. Most of the groundwork for this study was established at NCAR in thermal energy balance analyses of an earlier version of the CCM and more recently of CCM1. This report is intended as a guide for CCM1 users. The author assumes familiarity with the model and its associated postprocessor code. Symbols which are not explicitly defined below have the meanings they are given in the above-mentioned references. 5 refs., 3 figs.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 2770, 2771, 3110, 3129, 3132, 3133, 3493, 3534, 3593, 3610, 3617, 3618, 3619, 3620, 3641, 3642, 3643, 3644, 3645, 3646, 3647, 3648, 3649, 3650, 3652, 3654, 3661, 3663, 3664

3495 (AD-A—196476/6/XAB) Air-quality management alternatives: United States Air Force fire-fighter training facilities. Doctoral thesis. Brewer, R.E. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 312p. (AFIT/CI/NR—88-128). NTIS, PC A14/MF A01.

Air-pollutant emissions from fire-fighter training fires are a small portion of all annual air emissions from fixed and mobile sources at an Air Force installation. However, a single-practice fire burning 300 gallons of aviation fuel releases an estimated one ton of criteria air pollutants during a one- to five-minute period. Bases report conducting fire-fighter training 4 to 134 times per year, burning 100 to 2000 gallons of fuel per fire. Based on current emissions-inventory methodology, 4 installations emit over 100 tons of air pollutants annually from fire-fighter practice fires. A research methodology utilizing questionnaires, interviews, and site visits is developed and applied. This method enabled fire-prevention and environmental-management experts and professionals to provide data, opinions, and to evaluate candidate air-quality management alternatives. Analysis of survey data, interview findings, opinions, and management alternative evaluations integrated with air-quality-management indexes developed through this research lead to the study conclusions and recommendations. Implications for future policy and actions include recommendations to improve recording and reporting data via Facility Use and Firefighter Training Indexes. If adopted, the policy and actions would result in a more-efficient and standardized fire-fighter training program Air Force-wide. Further research is needed to verify air-emission factors, and to determine concentrations of PAH emissions in smoke and fugitive soot particles.

3496 (AD-A—196869/2/XAB) Impact of an increase in atmospheric methane on the temperature field and subsequent climatic effects. Master's thesis. Morrison, J.S. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 65p. (AFIT/CI/NR—88-18). NTIS, PC A04/MF A01.

In this thesis, the direct radiative effects on the temperature field due to the doubling of atmospheric methane are presented, within the context of a globally representative reference atmosphere, and climatic consequences are inferred. Based on the theory of infrared radiative transfer in a plane-parallel atmosphere, this simulation computed the vertical distribution of the change in longwave radiative heating rates that occurs as a result of doubling atmospheric methane. The interaction of methane with other atmospheric constituents which are optically active within the spectral boundaries of the absorption band for CH_4 was considered in the analysis of the results. The radiative interaction between water vapor and increased methane was shown to be the dominant reason for a positive change in heating rates in the lower troposphere when methane is doubled.

3497 (AD-A—196950/0/XAB) Characterization of the background natural aerosol in the west of Ireland. Interim report No. 3. Jennings, S.G. (University Coll., Galway (Ireland)). May 1987. 35p. NTIS, PC A03/MF A01.

This interim report describes: (i) Aerosol particle number and size distributions for ambient air at Mace Head Atmospheric Research Station, Carna in the West of Ireland about 50 miles west of Galway City. (ii) Intercomparison of particle sizing instrumentation used by University College Galway and UMIST, Manchester. (iii) Calculations of optical extinction and lidar backscatter to extinction ratios at predominantly laser wavelengths from the visible to middle-IR - based on measured aerosol particle-size distributions.

3498 (CONF-8810223—1) Recovery of lotic periphyton communities after disturbance: Draft. Steinman, A.D.; McIntire, C.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 62p. NTIS, PC A04/MF A01. Order Number DE89002201/JAW.

From U.S. Environmental Protection Agency lotic ecosystem recovery symposium; Duluth, MN, USA (3 Oct 1988).

The first section of this paper analyzes how site availability, species availability, and differential species performance influence periphyton successional dynamics. This background information provides a foundation for understanding how periphyton communities respond after a disturbance. The paper's second section analyzes how periphyton communities respond to four different types of disturbance (flood events, desiccation, nutrient enrichment, and toxic metal exposure). Although data are limited, lotic periphyton communities are relatively resilient. Fast growth rates and generation times of periphytic organisms, coupled with their flexible life history strategies and good dispersal ability, should enable these communities to recover to a pre-disturbance, community biomass level within weeks to months after a disturbance. However, disturbance type and severity, local environmental conditions, and site-spe-

cific factors also will influence recovery rates. Future research needs include a better understanding of interactions between autotrophs and heterotrophs within the periphyton mat, particularly with respect to nutrient cycling, competitive interactions among organisms; functional specificity of organisms; and the influence of the riparian zone and channel geomorphology on periphyton recovery rates. 173 refs., 3 tabs.

3499 **(DOE/EV/10337—3) [Measurements of spectroscopic studies of hydroxyl radicals in the atmosphere]: Final report.** (Ford Motor Co., Dearborn, MI (USA)). [1986]. Contract AC02-80EV10337. 5p. NTIS, PC A02/MF A01. Order Number DE89001966/JAW.

We have studied the spectroscopy of OH and have made accurate determination of many physical parameters which are needed in deducing OH concentrations from absorption and fluorescence measurements. The question of ozone interference in fluorescence measurements was addressed carefully, and shot noise limited detection using the LIDAR configuration for fluorescence measurements was demonstrated. We have also conducted a number of field tests for our instrument package, and have evaluated and developed the absorption technique both as a measurement technique as a means for calibrating the fluorescence measurements. 24 refs.

3500 **(LA-UR—88-3418) Phase differential scattering and polydispersity.** Johnston, R.G.; Salzman, G.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8806239—3). NTIS, PC A02/MF A01. Order Number DE89002130/JAW.

From CRDEC scientific conference on obscuration and aerosol research; Aberdeen, MD, USA (22 Jun 1988).

We have developed a new light scattering technique called Phase Differential Scattering (PDS), which utilizes a two-frequency, Zeeman effect laser. Some of our theoretical PDS results are presented here and compared with experimental measurements on aqueous suspensions of microspheres. According to theory, PDS should be very sensitive to average sphere size. Nevertheless, the effects of polydispersity appear to be less than expected. The Zeeman laser has other potential applications for aerosol research. 4 refs., 2 figs.

3501 **(PB—88-240361/XAB) Measurements of hydrogen peroxide and formaldehyde in Glendora, California. Final report, August 1986-January 1988.** Kok, G.L.; Walega, J.G.; Heikes, B.G.; Lind, J.A.; Lazrus, A.L. (National Center for Atmospheric Research, Boulder, CO (USA)). 22 Jan 1988. 26p. NTIS, PC A03/MF A01.

Gas-phase hydrogen peroxide (H_2O_2) and formaldehyde (HCHO) were measured in Glendora, California from August 14-21, 1986. These measurements were part of the Carbonaceous Species Methods Comparison Study sponsored by the California Air Resources Board. Both of these species were measured using enzymatic techniques: H_2O_2 by the peroxidase catalyzed dimerization of p-hydroxyphenylacetic acid and formaldehyde by the formaldehyde dehydrogenase catalyzed reduction of NAD^+ to NADH. Both H_2O_2 and HCHO showed a strong diurnal variation with the highest concentrations measured during the period of maximum photochemical activity. H_2O_2 concentrations ranged less than 0.1 ppbv at night to a maximum of 3 ppbv for the hourly average on one day. The HCHO concentrations ranged from a low of 5 ppbv at night to a maximum of 20 ppbv during the day.

3502 **(PB—88-240379/XAB) Health-Hazard Evaluation determination report HHE-74-60-255, Transportation Products Division, National Steel Corporation, Portage, Indiana.** Bloom, T.F.; Flesch, J.P.; Borcherding, C.H. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jan 1976. 12p. (HHE—74-60-255). NTIS, PC A03/MF A01.

A Health Hazard Evaluation investigation was conducted by NIOSH on May 1, 1975, at the Transportation Products Division, National Steel Corporation, Portage, Indiana, a facility engaged in the production of nailable steel floorings for railroad cars. The survey was prompted by a request from an authorized representative of the 21 affected employees regarding lack of ventilation in the production welding area which allegedly causes high exposure to welding fumes in employees working in adjacent areas. It was determined that production welders were exposed to iron oxide fumes in excess of the Threshold Limit Value established for the effluent. The conclusion is based on breathing-zone measurements and medical questionnaires completed for affected employees which provided evidence for the development of acute respiratory and eye irritation over the work shift. Recommendations for improved environmental control measures and work practices are outlined.

3503 **(PB—88-240445/XAB) Southern California Air Quality Study: summer phase. Final report.** Appel, B.R.; Tokiwa, Y.; Wu, Y.; Povard, V.; Kothny, E.L. (California Dept. of Health Services, Berkeley (USA). Air and Industrial Hygiene Lab.). Nov 1987. 51p. (CA/DOH/AIHL/SP—49). NTIS, PC A04/MF A01.

See also PB—88-223427.

During the Southern California Air Quality Study (SCAQS), sampling was performed at Long Beach for eleven, 24-hr. periods between June 19 and September 4, 1987. Sampling focused on fine particulate acids. Two fine particulate samplers were operated, with one of the units preceded by an ammonia denuder. In addition, a semi-continuous particle sulfur monitor was employed, which was able to discriminate between sulfuric acid and ammonium sulfates. Strong acid concentrations observed were very low, ranging up to 3 ug/cu m, expressed as H_2SO_4. Total particulate-acid concentrations were as high as 11 ug/cu m, expressed as H_2SO_4. Acidic sulfates contributed to no more than 20% of the strong acidity. Relatively strong organic acids (e.g., formic acid are possible important contributors to the particulate strong acids. Sulfuric acid concentrations with the particle S monitor were below detectable levels. Ammonium sulfate results with the S monitor showed moderate correlation with filter-collected sulfate ($r=0.82$) and averaged about 5 percent higher.

3504 **(PB—88-240452/XAB) Comparison of sampling methods for carbonaceous aerosols in ambient air. Final report, May 1987-April 1988.** Hering, S.V. (California Univ., Los Angeles (USA). Dept. of Chemical Engineering). 29 Apr 1988. 89p. NTIS, PC A05/MF A01.

Measurement methods for fine-particle carbon were compared under field-sampling conditions during the Carbonaceous Species Methods Comparison Study. Sampling methods included filtration, impaction and adsorption-corrected filtration. Systems were operated side-by-side for nine consecutive days in the Los Angeles Basin in August 1986. Analytical methods were compared separately. For organic carbon, ambient measurements showed greater variability than could be accounted for by differences in analytical measurements. Comparison of results from the different sampling systems and analysis of back-up filter data indicate adsorption artifacts on quartz-fiber filters can be significant. For the two impactor systems, the after-filters contained a large proportion of organic carbon (38% and 47%), but very little elemental carbon (5% and 12%). For systems employing tandem filters, the carbon found on the back-up filters was 14% to 53% of the aerosol carbon.

3505 **(PB—88-241419/XAB) Health-hazard evaluation determination report No. 74-111-283, Cook Paint and Varnish Company, North Kansas City, Missouri.** Flesch, J.P.; Hervin, R.L.; Lucas, J.B.; Hendricks, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1976. 14p. (HHE—74-111-283). NTIS, PC A03/MF A01.

Personal and general air samples were taken and employee interviews were completed at Cook Paint and Varnish Company in North Kansas City, Missouri, on October 23, 1974, May 5, and September 5 and 15, 1975. Particulate samples were collected. Standard analytical methods were used to analyze total dust, respirable dust, stannous octoate, and chromic oxide. Trimellitic-anhydride (TMA) samples were analyzed by rapid-esterification gas chromatography. Physical examination revealed eye and nasal irritation, shortness of breath, wheezing and cough, gastric distress, headache, and photophobia. Results of sampling indicated that exposure to chromic oxide and stannous octoate were less than 40% of the OSHA criteria of 1 and 2 milligrams per cubic meter (mg/cu m), respectively. Exposure to TMA ranged from 0.1 to 7.5mg/cu m, which exceeded the criteria of 0.1mg/cu m suggested by the authors. Total airborne

particulate dusts ranging from 3 to 77mg/cu m exceeded the Threshold Limit Value of 10mg/cu m for total nuisance dusts. The authors conclude that a health hazard exists at this site because workers were exposed to toxic concentrations of particulate matter and TMA.

3506 **(PB—88-241609/XAB) Illinois annual air-quality report, 1987.** (Illinois Environmental Protection Agency, Springfield (USA). Div. of Air Pollution Control). Jun 1988. 109p. (IEPA/APC—88-022). NTIS, PC A06/MF A01.

See also report for 1986, PB—88-117015.

This document summarizes ambient air-quality measurements obtained in Illinois during the calendar year of 1987. The report discusses air-quality data obtained for each site; provides statistical summaries, details air-quality violations, and provides trend data where available. Background information is included concerning sources of air pollutants, health effects, air quality standards, and ambient monitoring methodologies.

3507 **(PB—88-242094/XAB) NIOSH (National Institute for Occupational Safety and Health) report on occupational safety and health for FY 1976 under Public Law 91-596. Annual report.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Mar 1977. 110p. NTIS, PC A06/MF A01.

See also PB—84-182534.

The major activities of NIOSH from January 1 through September 30, 1976 were reviewed. An automated storage and retrieval information system was instituted to assist NIOSH personnel in handling requests for occupational safety and health information. Health and safety guides were published providing management-oriented information of OSHA standards and explanations of health and safety hazards. The series of Employee's Good Practices Manuals was developed. The Statistical Service branch prepared the Occupational Exposures Sampling Strategy Manual outlining a method for determining exposure. Many programs of engineering-control systems were completed and new ones were initial in the plastics, resins, and cutting-fluids industries. Exhaust-air follow-up studies were conducted. New performance criteria were developed for respirators. A test system of pesticide cartridge evaluation was implemented. Respiratory provisions were reviewed. Asbestos-exposure hazard research was continued. Routine analytical support was provided and 27,629 analyses were performed. Approximately 20,000 instruments were calibrated. The report describes the activities of the Chemical Reference Laboratory, the Division of Criteria Documentation and Standards Development and various spheres of international cooperation and liaison activities.

3508 **(PB—88-242102/XAB) NIOSH (National Institute for Occupational Safety and Health) report on occupational safety and health for FY 1977, under Public Law 91-596. Annual report.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1978. 161p. NTIS, PC A08/MF A01.

See also report for 1976, PB—88-242094.

The major activities of NIOSH during 1977 were presented. The main areas of concern were occupational reproductive hazards, manpower development, control technology, respiratory disease, and safety research. Research areas, types of technical assistance, hazard evaluation, and surveillance measures are discussed along with support services, criteria documentation, occupational-health-standards development, and the special foreign currency program which included research agreements in Yugoslavia, Poland, Egypt, and India.

3509 **(PB—88-242110/XAB) NIOSH (National Institute for Occupational Safety and Health) report on occupational safety and health for FY 1978, under Public Law 91-596. Annual report.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Mar 1979. 32p. NTIS, PC A03/MF A01.

See also report for 1977, PB—88-242102.

The major activities of NIOSH during 1978 are reviewed. Areas of health surveillance; health, safety, and control technology research; recommended standards, guidelines and hazard notifications; technical assistance and training and human-resource development are discussed. NIOSH issued 18 criteria documents, 10 Current Intelligence Bulletins, performed 6 special Hazard Reviews, and validated 29 methods as part of the joint NIOSH/OSHA Standards Completion Program. Ninety-nine Health Hazard Evaluation Toxicity Determination Reports were completed and 41 Technical Assistance Requests were answered. NIOSH issued 35 respiratory certifications and 208 extensions of respiratory certifications. Forty-seven sampling and analytical methods were developed, 40,459 analyses were performed on 16,978 samples and 80 training courses for 3,300 occupational safety and health practitioners were conducted. A total of 1.5 million copies of publications were distributed. The health and hazard surveillance program completed four reports including a study of chemical workers in Massachusetts, and angiosarcoma of the liver in vinyl chloride/polyvinyl chloride workers, and a rural health study. Acquisition of computerized data on 4 million establishments were completed. Occupationally induced malignancies in specified industries were also studied.

3510 **(PB—88-242128/XAB) NIOSH (National Institute for Occupational Safety and Health) report on occupational safety and health for FY 1979, under Public Law 91-596. Annual report.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1980. 30p. NTIS, PC A03/MF A01.

See also report for 1978, PB—88-242110.

The major activities of NIOSH during 1979 are reviewed. Areas of health surveillance, health, safety and control technology research; technical assistance and training and work-force development are discussed. About 250 Health-Hazard Evaluations are conducted each year. NIOSH is conducting approximately 35 epidemiologic studies to determine occupational disease among workers exposed to particular substances. Substances suspected to be teratogenic or to adversely affect reproduction are being studied. Surveillance efforts and special projects relating to forklift truck operators, industrial stairways, and the incidence of back injuries are described. Methods of dissemination of the results of safety research are being devised. The program for testing and certification of protective equipment has issued 93 respirator certifications and 259 extensions of certification during 1979. Control-technology research includes protective equipment, air recirculation, monitoring methods, and hazard control. NIOSH distributed over 750,000 copies of different publications during 1979.

3511 **(PB—88-242565/XAB) Field evaluation of sampling and analysis for organic pollutants in indoor air.** Chuang, J.C.; Mack, G.A.; Stockrahm, J.W.; Hannan, S.W.; Bridges, C. (Battelle Columbus Div., OH (USA)). Aug 1988. 182p. NTIS, PC A09/MF A01.

The objectives of the study were to determine the feasibility of the use of newly developed indoor air samplers in residential indoor air sampling and to evaluate methodology for characterization of the concentrations of polynuclear aromatic hydrocarbons (PAH), PAH derivatives, and nicotine in residential air. Residential air sampling was conducted in Columbus, Ohio during the winter of 1986/87. The PAH derivatives were found at much lower levels than their parent PAH. Higher average indoor levels of all but three target compounds were found compared to outdoor levels. The higher outdoor levels of these three compounds (naphthalene dicarboxylic acid anhydride, pyrene dicarboxylic acid anhydride, and 2-nitrofluoranthene) are probably due to atmospheric transformation. Cigarette smoking was identified as the most-significant contributor to indoor levels of PAH and PAH derivatives. Homes with gas-heating systems appeared to have higher pollutant levels compared to homes with electric-heating systems.

3512 **(PB—88-243571/XAB) Effects of ozone on primary determinants of plant productivity. Final report, 15 May 1986-15 February 1988.** Olszyk, D.M.; Heath, R.L.; Takemoto, B.K. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Apr 1988. 146p. NTIS, PC A07/MF A01.

This study evaluated the relationships among ozone exposure, gas exchange, chlorophyll fluorescence, and whole-plant productivity for Spinacea oleracea. Lactuca sativa, Zea mays, Cucumis pepo, and Raphanus sativus in a greenhouse with plants grown hy-

droponically (spinach) or in loose media (other species) to allow recovery of root systems. Spinach showed decreases in stomatal conductance and transpiration, with variable exposure producing greater effects than constant exposure. Net photosynthesis was affected by ozone less than were the gas-exchange parameters. Radish was the only species showing consistent ozone effects with reductions in both shoot and root dry weight. Gas exchange was not consistently correlated with productivity. Chlorophyll fluorescence measurements were stable and reproducible, but changes in fluorescence induced by low ozone levels were not easily observed. The study clearly showed that even though changes in gas exchange and plant productivity occur with ozone exposure, the relationships among them are difficult to detect.

3513 **(PB—88-243779/XAB) Measurement of atmospheric dry deposition at Emerald Lake in Sequoia National Park. Final report.** Bytnerowicz, A.; Olszyk, D. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). 11 Apr 1988. 68p. NTIS, PC A04/MF A01.

The primary objective of the study was to evaluate atmospheric dry deposition of major anions and cations to trees in the Emerald Lake area of Sequoia National Park. The field work was performed between July 15 and September 10, 1987. Teflon-coated and non-coated branches of native lodgepole pine (Pinus concorta) and western white pine (P. monticola), and potted seedlings of Coulter pine (P. coulteri) were rinsed using deionized-distilled water. Nylon and paper filters were exposed along with the vegetation, and were extracted in deionized-distilled water. The rinses and extracts were analyzed for concentrations of nitrate, sulfate, phosphate, chloride, fluoride, ammonium, and metallic cations. The deposition of nitrate to paper filters and to Coulter pine branches was significantly higher than deposition to the native conifers. Deposition of nitrate was significantly greater than deposition of sulfate, supporting earlier studies of chapparal in the South Coast Air Basin. Ammonium deposition was also quite high, suggesting that transport from the valley may be a significant source of dry deposition in the Sierra.

3514 **(PB—88-244215/XAB) Southern California air-quality study: tunable diode-laser absorption spectrometer measurements of HNO_3 at the Claremont A site. Final report.** MacKay, G.; Karecki, D.; Schiff, H.I. (Unisearch Associates, Inc., Concord, Ontario (Canada)). 16 Mar 1988. 52p. NTIS, PC A04/MF A01.

See also PB—86-223427.1.

The tunable diode laser absorption spectrometer was used during the Southern California Air Quality Study to continuously measure the concentration of gas-phase nitric acid at Claremont, California. The measurements were made from June 15 through July 24, 1987. The detection limit was less than 0.1 ppbv for 1 minute averaging times. The data are presented in 1-minute, 15-minute, and 1-hour averages. Data recovery was better than 90%. The diurnal behavior of nitric acid was quite regular. The maximum concentrations occurred between 1200 and 1800 each day. The daily maximum varied considerably during the study from a low of 5 ppbv on July 21 to a high of 24 ppbv on June 25. Nighttime minima occured between 2200 and 0600 and were generally in the range 0.5 to 1 ppbv.

3515 **(PB—88-246285/XAB) Design and testing of the SCAQS (Southern California Air Quality Study) sampler for the scaqs study, 1987. Final report.** Fitz, D.; Zwicker, J. (AeroVironment, Inc., Monrovia, CA (USA)). 11 Feb 1988. 137p. (AV-FR—87/649). NTIS, PC A07/MF A01.

See also PB—86-223427.

The principal objectives of the project were the design, construction, and testing of an integrated gas and aerosol sampler in order to provide a set of nine equivalent samplers for the Southern California Air Quality Study (SCAQS). The prototype sampler showed a precision of 3 to 7%. Significant losses of ammonia and nitric acid in the original prototype sampler were reduced to less than 5% in the final design. The side-by-side evaluation showed that the coefficients of variation of the mean concentrations averaged over all samplers for each of the 20 species determined were within the overall detection limits. The final result was the delivery of nine fully tested and equivalent samplers to the California Air Resources Board.

3516 **(PB—88-246301/XAB) Analysis and interpretation of the 1985 Sequoia transport experiment. Final report.** Myrup, L.; Flocchini, R. (Twin Pipes, Davis, CA (USA)). Oct 1987. 67p. NTIS, PC A04/MF A01.

An analysis and interpretation is presented of the 1985 Aerosol Transport and Characterization Program at Sequoia National Park, sponsored by the California Air Resources Board. Overall, it was found that the Program produced unique data sets and interesting new results relating particulate air quality and meteorology in the context of complex terrain. The major conclusion is that the meso-scale wind field, as modulated by synoptic-scale fluctuations, is the chief factor acting to cause variation in particulate concentrations in the Park. Areas for future work are discussed. In addition, it was recommended that in future measurement programs, greater effort be made to locate sites completely unaffected by local sources of pollutants.

3517 **(PB—88-246392/XAB) Characterization of diesel particles in the atmosphere. Final report, 1978-1980.** Kittelson, D.B.; Kadue, P.A.; Scherrer, H.C.; Lovrien, R.E. (Minnesota Univ., Minneapolis (USA)). Mar 1988. 354p. NTIS, PC A16/MF A01.

This report describes results of experiments designed to examine the physical, chemical and biological properties of diesel particles that have been subjected to atmospheric dilution and aging. Five field studies were done: three studies of particles in the exhaust plumes of diesel highway tractors operating on roadways, a study of particles upwind and downwind of slowly moving diesel trucks, and a study of particles upwind and downwind of a diesel-engine test center. The principal physical properties measured were particle mass, number, and volume concentrations; size distributions; and light scattering and absorption cross sections. Chemical and biological measurements made on the particles include determinations of solvent extractable fractions, characterizations of the extracts using liquid chromatography and high-performance liquid chromatography, and, in later studies, determinations of mutagenic response of the extracts using the Ames test.

3518 **(PB—88-247481/XAB) Measurements of NO_2, HONO, NO_3, NCHO, PAH, nitroarenes, and particulate mutagenic activities during the carbonaceous-species-methods comparison study. Final report, 9 July 1986-30 July 1987.** Atkinson, R.; Winer, A.M. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Feb 1988. 150p. NTIS, PC A07/MF A01.

The ambient concentrations of NO_2, HONO and HCHO were measured by long-pathlength differential optical absorption spectroscopy. Ambient concentrations of HNO_3, NH_3 and HCHO were measured by long-pathlength Fourier infrared-absorption spectroscopy. Significant concentrations of these pollutants were observed. Ambient air samples were analyzed for mutagenicity and gas- and particle-associated polycyclic aromatic hydrocarbons (PAH) and nitroarenes. The mutagen densities obtained were consistent with those measured previously in the South Coast Air Basin. The following PAH and nitroarenes were observed and quantified: naphthalene, 1- and 2-methylnaphthalene, biphenyl, acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene, dibenzothiophene, fluoranthene, pyrene, benz(a)anthracene, chrysene/triphenylene, benzo(a)pyrene, 1- and 2-nitronaphthalene, 3-nitrobiphenyl, 2-, 3- and 8-nitrofluoranthrene, and 1- and 2-nitropyrene.

3519 **(PB—88-247598/XAB) Continuous optical monitoring of asbestos in air.** Stolwijk, J.A.J. (John B. Pierce Foundation of Connecticut, Inc., New Haven (USA)). 1980. 8p. NTIS, PC A02/MF A01.

A continuous optical monitor for the identification and counting of asbestos fibers in ambient air, in occupational and residential environments was developed. Early designs consisted of a fiberglass tube with an internal diameter of 1.0 centimeter and a length of 8 centimeters with four internal electrodes. A 2 milliwatt He/Ne laser was positioned down the center of the tube. External air was sucked into the tube and polarizable fibers caused to spin at the quadrature frequency reflecting the laser light at right angles to the long axis of the fiber. A photomultiplier captured the pulses of light generated and fed the data to a small computer. One draw-

back of the system was that fiberglass and samples of different types of asbestos produced output signals which were very similar. A new design was developed that employed eight electrodes made from round platinum wires. Long fibers were distinguished from short fibers by the narrowness of the beam reflected.

3520 **(PB—88-247838/XAB) Minerals research progress report No. 1.** (Nevada Univ., Reno (USA). Dept. of Chemical and Metallurgical Engineering). Jul 1971. 96p. NTIS, PC A05/MF A01.

See also PB—88-237748.

Projects underway involving the surface chemistry of natural minerals, mineral separation methods, means of extracting metals from minerals, and techniques for reducing atmospheric and water pollution which result from mineral-processing operations are described. Individual papers included research on the following topics: dissolution and cation-exchange properties of some asbestos materials; some surface properties of asbestos minerals; variation of point of zero-charge of oxide minerals as a function of aging time in water; a comparison of measured and calculated point of zero charge values for chrysotile, serpentine, and crocidolite; carcinogenesis of asbestos fibers as related to surface chemistry; amphoteric surfactants as flotation collectors; dissolution studies of amosite and crocidolite in aqueous solution in the absence of atmospheric carbon dioxide; characteristics of the activity of submicroscopic surface regions of chrysotile.

3521 **(PB—88-247861/XAB) Health-hazard evaluation report HETA-85-436-1886, Roaring Fork Transit Agency, Aspen, Colorado.** Pryor, P.; Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1988. 19p. (HETA—85-436-1886). NTIS, PC A03/MF A01.

In response to a request from the employees at the Roaring Fork Transit Agency, Aspen, Colorado, an evaluation was made of possible health hazards in the bus-repair storage area resulting from diesel emissions. Samples taken at the site indicated that although detectable levels of sulfur dioxide, nitrogen dioxide, total particulates, formaldehyde and carbon monoxide (CO) were present in the work area, and were higher in winter than summer months, they were still below levels considered to be hazardous. The reservation's room was found to have short-term CO levels ranging from 7 to 35 parts per million. The authors conclude that a health hazard did not exist for workers in the bus-storage barn during this evaluation. A potential hazardous exposure to CO was identified in the reservationist's room.

3522 **(PB—88-247937/XAB) Health-hazard evaluation report HETA-84-217-1884, Children's Hospital, National Medical Center, Washington, DC.** Crandall, M.S. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1988. 33p. (HETA—84-217-1884). NTIS, PC A03/MF A01.

An evaluation was made of exposures to ethylene oxide (EtO) in the Sterile Processing and Distribution (SPD) department at Children's Hospital, National Medical Center, Washington, D.C. An initial survey was conducted in March 1984, a follow up survey in December 1985, and a second follow up in May 1986, following repairs to the aeration-chamber control system. In May 1986, 17 air samples were collected at six locations. No EtO was detected prior to a demonstration run. During the demonstration a concentration of 0.66 parts per million (ppm) was found in the mechanical room. During the first exhaust phase, concentrations around the system ranged from 0.28 to 0.39 ppm. During the second exhaust phase, EtO concentrations were near 0.1 ppm. While the EtO concentrations measured during this visit were significantly lower than those which had been measured during earlier visits, the potential for exposure on a daily basis was still unnecessarily high and unacceptable for workers in the SPD department. It is recommended that this sterilization equipment no longer be used, and that sterilization equipment with engineering controls which could limit exposure to EtO be installed.

3523 **(PB—88-250659/XAB) Mixture effects in the catalytic oxidation of VOCS (volatile organic compounds) in air. Final report, June 1985-December 1987.** Gangwal, S.; Ramanathan, K.; Caffrey, P.; Mullins, M.; Spivey, J. (Research Triangle Inst., Research Triangle Park, NC (USA)). Aug 1988. 84p. NTIS, PC A05/MF A01.

This report gives results of a study of the deep oxidation of organic mixtures over a heterogeneous catalyst in an attempt to explain earlier observations concerning the apparent inhibition or enhancement of destruction of some components to establish a scientific basis for the design and operation of catalytic incineration systems for volatile organic compound (VOC) control. The Mars/van Krevelen (MVK) reaction rate model satisfactorily represented the results for some single organic compounds at lower temperatures. By incorporating pore-diffusion effects, the MVK model adequately explains the single component data over the entire temperature range for some of the compounds. A multicomponent MVK model incorporating competitive adsorption effects is moderately successful in predicting the observed behavior for a binary mixture of benzene and n-hexane.

3524 **(PNL-SA—15916) Phototype design and testing of two fiber-optic spectrochemical emission sensors.** Olsen, K.B.; Nelson, D.A.; Griffin, J.W.; Matson, B.S.; Eschbach, P.A. (Pacific Northwest Lab., Richland, WA (USA); Washington State Univ., Pullman (USA). Dept. of Physics). Sep 1988. Contract AC06-76RL01830. 28p. (CONF-8810133—2). NTIS, PC A03/MF A01. Order Number DE89001741/JAW.

From Field screening methods for hazardous waste site investigations; Las Vegas, NV, USA (11 Oct 1988).

A unique radio frequency-induced helium plasma (RFIHP) sensor and a spark discharge (SD) sensor were designed, and prototype units were developed and tested. Both sensors use an atomic excitation source coupled to a fiber-optic cable and optical spectrometer to monitor in situ the emission intensity of selected elements of interest in the ambient air. Potential applications include vadose zone monitoring of volatile species. The RFIHP sensor was designed to measure the total chlorine concentration from carbon tetrachloride (and other volatile chlorinated hydrocarbons), and the SD sensor was designed to measure in situ concentrations of chlorine-containing compounds. The results of this research demonstrate proof of concept of the theory, but suggest further refinements are necessary to achieve detection sensitivities sufficiently low to be useful for monitoring concentrations of selected elements in vadose zone air. 9 refs., 10 figs.

3525 **(UCID—21287-Rev.1) Pollutant transport study: Bay Area to North Central Coast air basin: Final report.** Penner, J.E.; Connell, P.S. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 204p. NTIS, PC A10/MF A01. Order Number DE89002857/JAW.

A multi-layer photochemical transport model has been developed and applied to study the transport of pollutants from the Bay Area to the North Central Coast air basin. This study was motivated by questions which arose during the 1982 Bay Area Air Quality Plan Update. The primary concern was the impact of hydrocarbon and nitrogen oxide emissions in the Bay Area on downwind areas in the MBUAPCD. In particular, the Bay Area had adopted a hydrocarbon control strategy which did not seek active control of nitrogen oxide emissions. This strategy was based on photochemical modeling with the Livermore Regional Air Quality Model (LIRAQ) which had shown that control of nitrogen oxides would lead to local increases in ozone. The concern was that such a strategy, while helping to decrease ozone locally, would nevertheless increase ozone downwind. To study this issue required the development of a model capable of treating a several-day smog episode so that transport times sufficient to describe inter-basin transport episodes could be described. This required the development of a multi-level photochemical transport model to self-consistently describe the storage of pollutants overnight above the mixed-layer. The model was applied to simulate the ozone episode of September 30 and October 1, 1980. For this work, a two basin emissions inventory for 1980 was prepared. In addition, meteorology fields for the two-basin model domain were prepared. In order to do this an up-

dated version of the MATHEW model was developed which allows the user to specify the mixed-layer depth and restricts flow across that layer. 75 refs., 145 figs., 25 tabs.

3526 **(UCRL—21025) A methodology for evaluating heavy gas dispersion models: Final report, November 1985--February 1988.** Ermak, D.L.; Merry, M.H. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 121p. (ESL-TR—88-37). NTIS, PC A07/MF A01. Order Number DE89001535/JAW.

This report presents a methodology for evaluating the effectiveness of mathematical models in predicting the atmospheric dispersion of heavier-than-air vapor releases. The methodology is based upon ratio comparisons of the model-predicted value to the observed value in field-scale experiments involving continuous releases of denser-than-air gases. Plume characteristics used in the ratio comparisons include maximum concentration, center-line concentration, plume half-width, and plume height, all as a function of downwind distance from the source. Also included in the report is a review of the scientific efforts in the field of atmospheric dispersion model evaluation during the past two decades. 22 refs., 14 figs., 7 tabs.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 3032, 3058, 3461, 3552, 3627

3527 **(CONF-880912—16) Carbon isotope mass transfer as evidence for contaminant dilution.** Toran, L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01. Order Number DE89002205/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Carbon isotope data provided evidence for dilution of sulfate- contaminated groundwater that would not be predicted from thermodynamic reaction path modeling alone. The effect of CO_2 outgassing and carbonate precipitation and dissolution on $\delta^{13}C$ of dissolved inorganic carbon was modeled with an integrated form of Rayleigh distillation. The observed carbon isotope ratios were 2-4 {per←thousand} lighter than those modeled for most samples, indicating an additional source of light carbon. Mixing with background water is hypothesized to explain the discrepancies. Alternative hypotheses include sulfide oxidation and CO_2 outgassing at pH less than or equal to 5 and siderite precipitation, which preferentially removes heavy carbon. 17 refs., 4 figs., 4 tabs.

3528 **(DP-MS—88-195) A tool for qualitative evaluation of atmospheric transport models using ANATEX [Across North America Tracer Experiment] data.** Pendergast, M.M.; Bowman, W.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 6p. (CONF-881193—1). NTIS, PC A02/MF A01. Order Number DE89002027/JAW.

From Evaluation of atmospheric dispersion models applied to the release from Chernobyl meeting; Vienna, Austria (14 Nov 1988).

The emphasis of this paper will be to describe the method used to construct the film loops for the qualitative model evaluation of the ANATEX models. The value of these film loops as a tool used in the evaluation process is demonstrated by the construction of a film loop presented in the sample video accompanying this paper. The Across North America Tracer Experiment (ANATEX) model evaluation study being conducted by the US Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration/Air Resources Laboratory (NOAA/ARL) provides evaluation of several atmospheric transport models in 'blind' tests using the ANATEX database. A 'blind' test is one in which the modelers do not have access to the observed concentration data before they submit their results for evaluation. The Savannah River Laboratory (SRL) in Aiken, South Carolina, has been asked to supplement this quantitative information with their qualitative evaluations using color graphical displays. The participants of the ANATEX model evaluation study have provided to SRL calculated tracer concentrations at the 77 ANATEX sampler locations covering most of Central and Eastern United States and Southern Canada. Daily model and observed concentrations have been used to construct film loops. The film loops of concentration data show areas of agreement and disagreement in tracer concentration but do not provide clues as to their cause. The superposition of analyses of various meteorological variables onto the maps of tracer concentration provides valuable information to the modeler. The meteorological analyses used in the film loops are obtained from the SRL model at six-hour intervals and consist of all the commonly observed variables such as temperature, dewpoint temperature, terrain height, pressure and wind velocity, and derived variables such as divergence and vorticity. The film loops are recorded on video tape for ease of study. 1 ref., 2 tabs.

3529 **(INIS-BR—1295) Inversions of radon vertical profile in the troposphere.** Pereira, E.B.; Lemes, M.A.M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704535/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

3530 **(INIS-BR—1297) Results of observations on natural radionuclides during the winter/1986 in the comandante Ferraz Antartic Station.** Pereira, E.B.; Nordemann, D.J.R.; Mantelli Neto, S.L.; Takashima, A.M.; Sampaio, M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704537/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

3531 **(LA—11368-MS) The Canadian experimental HT release of June 10, 1987, US measurements.** Jalbert, R.A.; Murphy, C.E. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 31p. NTIS, PC A03/MF A01. Order Number DE89002103/JAW.

In June 1987, an experiment was performed at the Chalk River Nuclear Laboratories in Ontario, Canada, to study the oxidation of elemental tritium (HT) released to the environment. The experiment involved a 30-minute release of 3.54 TBq (95.7 Ci)of HT to the atmosphere at an elevation of one meter. Scientists from six countries participated in the experiment. The air measurements showed HT concentrations downwind of the release in general agreement with classical atmospheric diffusion (Gaussian) up to the maximum distance measured (400 m). The HTO/HT ratios were shown to slowly increase downwind (~ 4 x 10/sup {minus}5/ at 50 m to almost 10/sup {minus}3/ at 400 m) as conversion of HT took place. After the release, HTO concentrations in the atmosphere remained elevated. Vegetation samples were also taken since the vegetation and associated soil system have been implicated in the oxidation of HT. Freeze-dried water from vegetation samples was found to be low in HTO immediately after the release suggesting a low direct uptake of HTO in air by vegetation. The tritiated water concentration increased during the first day, peaking during the second day (about 15--30 kBq/L of water at 50 m from the source), and decreasing by the end of the second day. This pattern suggests oxidation in the soil followed by plant uptake through sorption of soil water. This was confirmed by measurements taken by other groups at the experiment site. The HTO in vegetation decreased with distance downwind with the same pattern as the HT measured during the release indicating that the oxidation of HT was linearly related to the HT concentration in the atmosphere during the exposure period. An adequate description of the process can be made through the observed phenomenon of HT deposition into the soil with subsequent rapid oxidation by soil bacteria. 30 refs., 10 figs., 4 tabs.

3532 **(ORNL/M—532/R1) Environmental surveillance data report for the first quarter of 1988.** Blasing, T.J.; Daniels, K.L.; Goldberg, P.Y.; Horwedel, B.M.; McCollough, I.L.; Osborne-Lee, A.E.; Valentine, C.K.; Wolf, D.A. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 90p. NTIS, PC A05/MF A01. Order Number DE88017036/JAW.

During the first quarter of 1988, over 1800 samples which represent more than 6000 analyses and measurements were collected by the Environmental Monitoring and Compliance (EMC) Department. More than ten real-time monitoring stations, which telemeter 10-minute averaged readings of radiation levels, total precipitation, flows, water, and air quality parameters around ORNL also reported data. In addition, three meteorological towers sent weather data at various heights to a host computer every 15-minutes. Real-time measurements of external gamma radiation are now being reported from several stations, included some recently activated or upgraded stations. Measurements this quarter indicate that external gamma radiation around ORNL is close to background, except at station 4, which is located between the Waste Treatment Plant and waste treatment ponds and therefore experiences higher levels of radiation. Cobalt-60 concentrations in Melton Branch remained low, as they had been during the fourth quarter of 1987. Lack of discharge from the HFIR ponds is the apparent cause of the reduced concentrations, as these ponds appear to be the source of most of the cobalt-60 that does occur in Melton Branch. Flow-weighted concentration of radionuclides in surface water were found to be generally much lower than the DOE derived concentration guidelines except for tritium in Melton Branch. Tritium concentrations measured at Melton Branch Site 1 exceeded the corresponding guideline by 30% during March.

3533 **(PB—88-241245/XAB) Response to request to provide assistance in establishing emergency criteria applicable to elevated indoor radon concentrations. Structures built on the Reading Prong. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 5 Nov 1985. 6p. (SAB/RAC—86/005). NTIS, PC A02/MF A01.

On September 4, 1985 Mr. Sheldon Mayers, the Acting Director of the Agency's Office of Radiation Programs, requested the assistance of the Science Advisory Board in establishing emergency criteria applicable to elevated indoor radon concentrations in structures built on the Reading Prong. (1) Is a range of relative risk coefficients of 1.2 to 2.8 percent a reasonable range for the Agency to use in evaluating the risks associated with exposures at and above various alternative interim emergency action levels for the Reading Prong. (2) Are there any special considerations that should be taken into account in calculating the risks associated with short-term exposures to radon decay products versus lifetime exposures.

3534 **(WAPD-RC/E(RH)—123) 1987 effluent and environmental monitoring report for the Bettis Atomic Power Laboratory.** (Bettis Atomic Power Lab., West Mifflin, PA (USA)). 1987. Contract AC11-76PN00014. 56p. NTIS, PC A04. Order Number DE88012945/JAW.

The results of the radiological and non-radiological environmental monitoring programs for 1987 at the Bettis Laboratory are presented. The results obtained from the monitoring programs demonstrate that the existing procedures ensure that all environmental releases during 1987 were in accordance with applicable federal and state regulations. Evaluation of the environmental data indicates that operation of the Laboratory continued to have no adverse effect on the quality of the environment. Furthermore, a conservative assessment of radiation exposure to the general public as a result of Laboratory operations demonstrated that the dose received by any member of the public was well below the most restrictive dose limits prescribed by the Environmental Protection Agency and the Department of Energy. 30 refs., 5 figs., 13 tabs.

5006 Regulations

REFER ALSO TO CITATION(S) 3130, 3533

3535 **(PB—88-241427/XAB) Benzene emissions from coke by-product recovery plants: background information for revised proposed standards. Final draft report.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Jun 1988. 277p. (EPA—450/3-88/016B). NTIS, PC A13/MF A01.

See also PB—84-176874. Errata sheet inserted.

National emission standards to control emissions of benzene from new and existing coke by-product recovery plants are being promulgated under Section 112 of the Clean Air Act. This document contains summaries of public comments, EPA responses, and a discussion of differences between the proposed and revised proposed standard.

3536 **(PB—88-241492/XAB) Summary of state VOC (volatile organic compound) regulations. Volume 2. Group 3 CTG (control technique guidelines) and greater than 100 ton per year non-CTG VOC regulations.** Clark, C.R.; Meardon, K.R. (Pacific Environmental Services, Inc., Durham, NC (USA)). May 1988. 255p. NTIS, PC A12/MF A01.

See also PB—85-249738.

In April of 1985, EPA published Summary of State VOC Regulations (EPA-450/2-85-003), which summarized regulations for Group I, II, and III CTG's and >100 tpy non-CTG categories as of August 1, 1984. This document updates and expands parts of that publication; specifically, it presents summaries of State and local regulations for Group III CTG's and >100 tpy non-CTG regulations. Information used to compile the document was collected from all 10 EPA regions in early 1987.

3537 **(PB—88-245659/XAB) Report of the Indoor Air Quality Research Review Panel: review of the Office of Research and Development's plan for determining future research needs on indoor air pollution. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 5 Nov 1986. 22p. (SAB/EC—87-002). NTIS, PC A03/MF A01.

The Panel concluded that while the indoor air research being conducted by the Environmental Protection Agency was of high quality, the research taken as whole did not constitute a program in indoor air quality. The major recommendations include: eight general conclusions and recommendations concerning current research in indoor air quality.

3538 **(PB—88-247226/XAB) Review of EPA's (Environmental Protection Agency's) assessment of the risks of stratospheric modification. Review of the Stratospheric Ozone Subcommittee of the Science Advisory Board. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). Mar 1987. 34p. (SAB/EC—87/025). NTIS, PC A03/MF A01.

The Subcommittee concluded that EPA's draft document represents an extensive effort to develop an integrated risk assessment based upon currently available scientific information to ascertain the potential threat to the stratosphere posed by a continued growth world-wide of emissions of chlorofluorocarbon (CFCs) compounds. The Subcommittee generally finds that EPA has done a commendable job of assembling the relevant scientific information in the body of the document. The Subcommittee has provided many specific recommendations for improving the treatment of particular scientific issues and characterizing scientific uncertainties which are detailed in the report.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 3268

3539 **(EGG—10282-1103) An aerial radiological survey of the Kennedy Space Center and Cape Canaveral Air Force Station and surrounding area, Titusville, Florida: Date of survey: October 1985.** (EG and G Energy Measurements, Inc., Las Vegas, NV (USA)). Jan 1988. Contract AC08-83NV10282. 28p. NTIS, PC A03/MF A01. Order Number DE89001862/JAW.

An aerial radiological survey of the entire Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS) was performed during the period 9 through 23 October 1985. This survey was conducted in three parts. First, a low resolution, low sensitivity background survey was performed that encompassed the entire KSC and CCAFS area. Next, two smaller, high resolution, high sensitivity surveys were conducted: the first focused on Launch Complexes 39A and 39B, and the second on the Shuttle Landing Facility. The areas encompassed by the surveys were 200, 5.5, and 8.5 square miles (500, 14, and 22 sq km), respectively. The purpose of these surveys was to provide information useful for an emergency response to a radiological accident. Results of the background survey are presented as isoradiation contour maps of both total exposure rate and man-made gross count superimposed on a mosaic of recent aerial photographs. Results of the two small, detailed surveys are also presented as an isoradiation contour map of exposure rate on the aerial photograph base. These data were evaluated to establish sensitivity limits for mapping the presence of plutonium-238. Natural background exposure rates at the Kennedy Space Center and Cape Canaveral Air Force Station are very low, generally ranging from 4 to 6.5 microroentgens per hour (μR/h) and less than 4 μR/h in wet areas. However, exposure rates in developed areas were observed to be higher due to the importation of construction materials not characteristic of the area. 8 refs., 3 figs., 4 tabs.

3540 **(JINR-E—14-87-677) Neutronographic texture investigation of metamorphic rocks.** Feldmann, K.; Fuentes, L.; Walther, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704851/JAW.

Submitted to the 8. International Conference on Texture of Materials ICOTOM 8, Santa Fe, USA, 20-25 September, 1987.

The neutron time-of-flight (TOF) diffraction is well suited for preferred orientation studies in low symmetric materials, for example, in quartzitic rocks, because of the simultaneous recording of the whole Bragg pattern. The unnormalized pole figure values are determined as integrated intensities of the corresponding diffraction peaks by a computer fit of the TOF spectrum. Unfortunately, many of natural rocks consist of more than one mineral. Therefore, the TOF diffraction pattern is a uperposition of spectra from all components, i.e. there is a lot of overlappings of different reflections. In this case the question arises about the reliability of the experimental pole figures. On the basis of complete experimental pole figures methods and criteria are discussed to check and to imrove their internal and external compatibility. These procedures may have importance in the study of other low symmetry of multiphased systems also. The efficiency of the presented methods is demonstrated for selected experimental results. 9 refs.; 4 figs.; 1 tab.

3541 **(JINR-E—14-87-678) Fabric analysis of the quartz components in orthogneisses using neutron time-of-flight diffraction.** Drechsler, L.P.; Feldmann, K.; Fuentes, L.; Kleinsteuber, W.; Walther, K.; Frischbutter, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics; Akademie der Wissenschaften der DDR, Potsdam. Zentralinstitut fuer Physik der Erde). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704852/JAW.

Submitted to the 8. International Conference on Textures of Materials ICOTOM 8, Santa Fe, USA, 20-25 September, 1987.

The crystalline preferred orientations of quartz grains in four orthogenesis are studied by means of neutron time-of-flight (TOF) diffraction. The specimens have been taken from characteristic spots of a recumbent fold structure in the Erzgebirge Mountains (southern GDR). The geological backgraound is shortly outlined. All the measurements are carried out at the pulsed reactor IBR-2 of the JINR, Dubna. Because of the complicated mineral composition of the samples some efforts have to be made to obtain internal and external compatibility of pole figures. Spherical harmonics analyses of experimental pole figures have been carried out up to ODF calculation. In all four samples single component textures have been found where the trigonal axes are parallel to the tectonic a direction. In the quartz basal plane pole figures the relatively strong maxima at +- a are connected by a girdle of weaker intensity. Comparing the preferred orientations of different samples the sharpness of textures is found to decrease from the crest to the limb of the fold without significant changes of the type of basal plane pole figures. From the pole figures of the prismatic planes a rotation of the oriented crystal around threefold axis can be observed. 10 refs.; 3 figs.; 2 tabs.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 3108, 3532, 3534, 3566

3542 **(AD-A—196671/2/XAB) Degradation of hazardous organic wastes by microorganisms. Preliminary report.** Kenis, P. (Naval Ocean Systems Center, San Diego, CA (USA)). May 1988. 77p. (NOSC/TD—1253). NTIS, PC A05/MF A01.

This report addresses the microbiological detoxification of hazardous organic compounds before and after they have contaminated soil, ground water, and other areas. The in-situ degradation of toxic organic compounds is often the most cost-effective cleanup approach. Companies that use or provide microorganisms and other products and services for hazardous organic waste detoxification are listed in the appendices of this report.

3543 **(DOE/EV/10467—2) A study of the physical-chemical mechanisms and variables which affect the transport of inorganic and organic contaminants in heterogeneous system: Final report.** Anderson, M.A. (Wisconsin Univ., Madison (USA). Dept. of Civil and Environmental Engineering). [1987]. Contract AC02-80EV10467. 61p. NTIS, PC A04/MF A01. Order Number DE89002726/JAW.

This research defines reaction mechanisms and key variables that account for distribution or partitioning of inorganic and organic solutes between the aqueous solution and solid phase adsorbents. The ultimate goal is to develop improved understanding of chemical equilibrium or kinetic rate dependencies which are important in predicting the movement of microcontaminant species in subsurface environments. The adsorbent chosen for study is goethite with emphasis largely on the protolyzable anions (arsenate, selenite and phosphate) and organics (benzoic acid, phenol and derivatives). We have also been concerned with proton behavior in these systems. The experimental approach uses batch adsorbate-adsorbent systems that are analyzed in time against changes imposed by altering adsorbate concentration, pH, ionic strength, and solid/solution ratios, as well as the adsorbent itself. Results are interpreted in terms of mechanisms consistent with the physical-chemical behavior of a heterogeneous colloid suspension. Major progress includes: (1) a descriptive mechanism for decreasing isotopic exchange with increasing adsorption, and effect of solid/liquid ratio in adsorption processes; (2) equilibrium description of pH and charge effects on strongly versus weakly bound anions; and (3) a mathematical description of the entropic forces in interfacial reactions.

3544 **(DOE/WIPP—87-003) Ecological Monitoring Program at the Waste Isolation Pilot Plant: Annual report for FY 1986.** Fischer, N.T. (ed.). (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Apr 1987. Contract AC04-86AL31950. 130p. NTIS, PC A07/MF A01. Order Number DE89002769/JAW.

This document reports data collected as part of the Ecological Monitoring Program (EMP) at the Waste Isolation Pilot Plant near Carlsbad, New Mexico, for fiscal year 1986. This report divides data collection activities into two parts. Part A covers general environmental monitoring which includes meteorology, aerial photography, air quality monitoring, water quality monitoring, and wildlife population surveillance. Part B focuses on the special studies being performed to evaluate the impacts of salt dispersal from the site on the surrounding ecosystem. These studies are in their third year and involve the monitoring of soil chemistry, soil microbiota, and vegetation in permanent study plots. There were no significant findings indicating that the WIPP project is having adverse impacts on environmental quality. Slight differences in the bird fauna between the areas adjacent to WIPP and the control locations were observed. This is probably due to changes in habitat structure and food supply caused by the construction of WIPP. These changes include the presence of more perches and nest locations resulting from fences, buildings, and other artificial structures, and greater number of insects attracted to the site by the installation of lights. An abrupt decline in the populations of small mammals in the Los Medanos Ecosystem was noted between the 1985 and 1986 censuses; however, there is no indication that it was related to WIPP activities. Possible natural causes of this decline are the unusual rainfall patterns, characterized by long dry periods and short periods of intense rainfall and reduced food supply due to a poor seed-set in annual plant species, also attributable to rainfall patterns. 13 refs., 44 figs., 12 tabs.

3545 **(DOE/WIPP—88-008) Ecological Monitoring Program at the Waste Isolation Pilot Plant: Annual report for calendar year 1987.** Fischer, N.T. (ed.). (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Aug 1988. Contract AC04-86AL31950. 217p. NTIS, PC A10/MF A01. Order Number DE89002766/JAW.

This document reports data collected as part of the Ecological Monitoring Program (EMP) at the Waste Isolation Pilot Plant near Carlsbad, New Mexico, for calendar year 1987. Also included are data from the last quarter (October through December) of 1986. This report divides data collection activities into two parts. Part A covers general environmental monitoring which includes meteorology, aerial photography, air quality monitoring, water quality monitoring, and wildlife population surveillance. Part B focuses on the special studies being performed to evaluate the impacts of salt dispersal from the site on the surrounding ecosystem. The fourth year of salt impact monitoring was completed in 1987. These studies involve the monitoring of soil chemistry, soil microbiota, and vegetation in permanent study plots. None of the findings indicate that the WIPP project is adversely impacting environmental quality at the site. As in 1986, breeding bird censuses completed this year indicate changes in the local bird fauna associated with the WIPP site. The decline in small mammal populations noted in the 1986 census is still evident in the 1987 data; however, populations are showing signs of recovery. There is no indication that this decline is related to WIPP activities. Rather, the evidence indicates that natural population fluctuations may be common in this ecosystem. 28 refs., 55 figs., 23 tabs.

3546 **(EPRI-EA—5818-Vol.2) Chemical data for predicting the fate of organic compounds in water: Volume 2, Database: Final report.** Gherini, S.A.; Summers, K.V.; Munson, R.K.; Mills, W.B. (Electric Power Research Inst., Palo Alto, CA (USA); Tetra Tech, Inc., Lafayette, CA (USA)). Oct 1988. 420p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002494/JAW.

This report is the second volume of a two volume series. It includes a complete listing of the physical and chemical properties and equilibrium and rate constants for the 53 compounds. An index is included showing the types of data available for each chemical. Volume 1 discusses methods used to evaluate the data and estimate missing values. Review of available information indicates that the data for transformation rates are less available than for physical and chemical properties. In particular, additional rate data for biotransformation and photolysis are most needed. Where such data do exist in the literature, the values are typically for experiments performed under laboratory conditions. Because of this, methods and examples are included in volume 1 for adjusting such values to field conditions (e.g., different temperatures). 254 refs., 10 tabs.

3547 **(PB—88-242391/XAB) Determination of effective porosity of soil materials. Final report.** Horton, R.; Thompson, M.L.; McBride, J.F. (Iowa State Univ. of Science and Technology, Ames (USA)). Aug 1988. 131p. NTIS, PC A07/MF A01.

The performance of a compacted soil liner is partly a function of the porosity, where the transport of materials through the liner occurs via the pore space. The project studies the pore spaces of compacted soil materials to estimate the effective porosity, which is the portion of the pore space where the most rapid transport of leachate occurs. Pore space of three soil materials, till, loess, and paleosol, was studied. These analyses provided cumulative porosity curves from which the pore size distribution of soil samples were estimated. Theory was developed to estimate the effective porosity of a compacted soil material based upon a model of its pore-size distribution and pore continuity. Comparisons between measured and predicted chloride travel times through compacted soil samples were made in order to verify the estimated effective porosities. The estimated effective porosities are reasonable because predicted chloride first breakthrough times are similar to the measured first-breakthrough times in the soils studied. For these three soils, predicted first-breakthrough times are 5 to 10 times earlier when effective porosity is used.

3548 **(PB—88-242672/XAB) Review of reports on landfilling and land-application alternatives to the ocean disposal of POTW sludges. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 15 Jan 1987. 18p. (SAB/EEC—87/013). NTIS, PC A03/MF A01.

In late 1985, the Environmental Engineering Committee of the Science Advisory Board was asked by the Office of Marine and Estuarine Protection (OMEP) to review technical documents supporting revisions to the Agency's ocean-dumping regulations. The two main issues were: (1) technical justification for the different regulatory treatment of the disposal of dredged materials; and (2) the consideration, in the ocean disposal of publicly owned treatment works (POTW) sludges, of both the need for ocean dumping and the availability and impacts of land-based alternatives. This report deals with the second of these issues only. Specifically, the report presents the Science Advisory Board review of the methodologies developed by EPA's Office of Policy Planning and Evaluation (OPPE) to analyze POTW sludge landfilling and land application as alternatives to ocean disposal of POTW sludges.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 2885, 2888, 2889, 2891, 2892, 2895, 2896, 2897, 3532, 3534

3549 **(DOE-RW—88.030) Joint review of related contracts on bird populations in the Ravenglass Estuary.** Anderson, N.; Evans, P.R.; Lowe, V.P.W. (Durham Univ. (UK); Merlewood Research Station, Grange-over-Sands (UK). Inst. of Terrestrial Ecology). (Department of the Environment, London (UK)). Oct 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754766/JAW.

Black-headed Gulls breeding at Ravenglass (and at other coastal sites in Cumbria) fed exclusively inland during the breeding season and so they and their young could not have acquired any radionuclides present in the estuarine muds and invertebrates. Levels in the invertebrates and in gull tissues were low; they were slightly higher in Shelducks, which feed on estuarine invertebrates but have nested successfully at Ravenglass in recent years. Gulls and two other ground-nesting bird species have suffered severe disturbance and predation by foxes in recent springs at Ravenglass; Shelducks nest in burrows and have escaped such effects. Levels of radionuclides in birds, particularly gulls, are too low to have caused breeding failures at Ravenglass.

3550 **(IC—88/170) Synoptic aspects of the central Chile rainfall variability associated with the southern oscillation.** Rutllant, J.; Fuenzalida, H. (International Centre for Theoretical Physics, Trieste (Italy); Chile Univ., Santiago (Chile). Dept. of Geophysics). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704722/JAW.

Central Chile winter rainfall patterns show a positive anomaly during the developing stage of warm events associated to the negative phase of the Southern Oscillation. On the other hand, cold events during the positive phase of the Southern Oscillation, correspond quite closely to dry conditions. However, several dry years seem to precede or follow warm events without being necessarily classified as cold events. A synoptic characterization of major winter storms during the development of the most recent warm events in 1972, 1982 and 1987, is presented. Dry winter months during cold-event years are described in terms of average 500 hPa contour anomaly fields. Significant departures from this general behavior, as storms not associated to warm events and extended dry periods during otherwise wet winters, are also analyzed. It is found that major winter storms occurring during the developing phase of warm events are related to hemispheric types of blocking and anomaly patterns where sonal wavenumber 4 and a particular phase of wavenumber 3 dominate. The blockings, located in the Bellingshausen sea area, split the westerly flow diverting the storm tracks towards central Chile. Cold years, often immediately preceding or following a warm event, bring dry conditions in the study area due to a well developed subtropical anticyclonic belt and predominantly sonal westerly flow. Superimposed on these general conditions, anomaly contour patterns in southern South America reveal opposite signs with respect to those associated to warm events. Heavy winter storms not coinciding with warm events show local types of blocking in the Antartic peninsula area, with meridionally or slightly NE-SW oriented troughs and ridges. Extended dry spells and rainfall episodes during warm-event winters seem to be connected with alternating subtropical anomalies moving east with an intraseasonal time scale, superimposed on the aforementioned anomaly pattern at high latitudes. (Abstract Truncated)

3551 **(PNL—6734) A review of historical data on the radionuclide content of soil samples collected from the Hanford Site and vicinity.** Price, K.R. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 117p. NTIS, PC A06/MF A01. Order Number DE89002851/JAW.

The measurement of radioactive materials in soil samples collected from the environs of the Hanford Site has been a routine part of environmental monitoring since 1971. Soil samples have also been collected and analyzed for special-purpose studies. The main objective of this report is to review and summarize the historical record of soil sampling results related to environmental monitoring from the late 1950s through 1987. Other objectives are to publish previously unpublished data and to consolidate results from routine environmental monitoring and special studies into a single document. 51 refs., 9 figs., 14 tabs.

3552 **(PNL-SA—16066) Iodine-129: Environmental monitoring and population dose in the Hanford environs.** Jaquish, R.E.; Price, K.R. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 7p. (CONF-8810112—4). NTIS, PC A02/MF A01. Order Number DE89001998/JAW.

From 34. annual conference on bioassay, analytical and environmental radiochemistry; Las Vegas, NV, USA (17 Oct 1988).

Iodine-129 is an important radionuclide to be considered in environmental monitoring programs in the vicinity of fuel reprocessing plants. Because of its long half-life, 1.6 {times} 10 ^{7} year, and active behavior in biological and environmental systems, it has the potential for accumulating in the environment from long-term, chronic releases. When the PUREX Plant at Hanford restarted reprocessing fuel in 1983, monitoring for ^{129}I was included in the environmental monitoring program conducted by Pacific Northwest Laboratory (PNL). Low levels of ^{129}I have access to environmental pathways from past airborne releases, current releases to the atmosphere, and ground-water seepage into the Columbia River. 4 refs., 2 figs., 1 tab.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 3584

5106 Regulations

3553 **(PB—88-242441/XAB) Criteria for municipal solid-waste landfills (40 CFR Part 258). Subtitle D of Resource Conservation and Recovery Act (RCRA). Summary of data on municipal solid-waste-landfill leachate characteristics. Draft report.** (NUS Corp., Rockville, MD (USA)). Jul 1988. 144p. NTIS, PC A07/MF A01.

In August 1988, the U.S. Environmental Protection Agency proposed Solid Waste Disposal Facilities Criteria (40 CFR Part 258) for municipal solid-waste landfills. This background document is the basis for the development of a portion of the Subtitle D criteria. The document presents information on the character of leachate from municipal solid-waste landfills based on a study of existing leachate data. The purpose of the document was to: (1) investigate municipal solid-waste-landfill leachate; (2) determine the constituents present; (3) determine the concentrations of the constituents present relative to human health and environmental regulatory standards; and (4) evaluate the effects of Subtitle C hazardous waste regulations on constituent concentrations in municipal solid-waste-landfill leachate. The document describes the sources of the data and its quality and presents the results of the study.

3554 **(PB—88-242458/XAB) Criteria for municipal solid-waste landfills (40 CFR Part 258). Subtitle D of Resource Conservation and Recovery Act (RCRA). Updated review of selected provisions of state-solid waste regulations. Draft report.** (NUS Corp., Rockville, MD (USA)). Jul 1988. 71p. NTIS, PC A04/MF A01.

In August 1988, the U.S. Environmental Protection Agency proposed Solid-Waste Disposal Facilities Criteria (40 CFR Part 258) for municipal solid-waste landfills. The background document is the basis for the development of a portion of the Subtitle D criteria. The document presents a review of selected provisions of State solid-waste regulations and analyzes the differences between the proposed criteria and current State and Territorial solid-waste regulations. The three specific criteria analyzed for in the document include: (1) facility design (liners, leachate-collection systems, and final covers); (2) ground-water monitoring; and (3) corrective action. The three aspects were compared to State regulations to determine whether the State had standards addressing these three areas, whether the State has the regulatory ground work that would allow the implementation or the development of the criteria.

3555 **(PB—88-242466/XAB) Criteria for municipal solid-waste landfills (40 CFR Part 258). Subtitle D of Resource Conservation and Recovery Act (RCRA). Case studies on ground-water and surface-water contamination from municipal solid-waste landfills. Draft report.** (NUS Corp., Rockville, MD (USA)). Jul 1988. 97p. NTIS, PC A05/MF A01.

In August 1988, the U.S. Environmental Protection Agency proposed Solid-Waste Disposal Facilities Criteria (40 CFR Part 258) for municipal solid-waste landfills. This background document is the basis for the development of a portion of the Subtitle D criteria. The document presents information on case studies dealing with ground-water and surface-water contamination from municipal solid-waste landfills. The purpose of the document was to identify and describe human health and environmental impacts (excluding subsurface gas migration) that have resulted from the operation of municipal solid-waste landfills and, where possible, determine what role the design, operation, and location of the facility played in creating the problem.

3556 **(PB—88-242508/XAB) Criteria for classification of solid-waste-disposal facilities and practices (40 CFR Part 257). Subtitle D of Resource Conservation and Recovery Act (RCRA). Notification requirements for industrial solid-waste-disposal facilities. Draft report.** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). Aug 1988. 16p. (EPA—530/SW-88/044). NTIS, PC A03/MF A01.

In August 1988, The U.S. Environmental Protection Agency proposed amendments to the existing 40 CFR Part 257 Criteria for Classification of Solid-Waste Disposal Facilities and Practices. The Agency proposed to require, in Part 257, a two-part reporting requirement for industrial solid-waste-disposal facilities and construction/demolition waste landfills. This background document discusses the notification and exposure information requirements for the above mentioned types of facilities.

3557 **(PB—88-242516/XAB) Criteria for municipal solid-waste landfills (40 CFR Part 258). Subtitle D of Resource Conservation and Recovery Act (RCRA). Regulatory Impact Analysis (RIA) of proposed revisions to Subtitle D Criteria for municipal solid waste landfills. Draft report.** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). Aug 1988. 275p. (EPA—530/SW-88/045). NTIS, PC A12/MF A01.

In August 1988, the U.S. Environmental Protection Agency proposed Solid-Waste Disposal Facilities Criteria (40 CFR Part 258) for municipal solid-waste landfills. This background document presents the Regulatory Impact Analysis (RIA) that was prepared to evaluate the Agency's proposed revisions to the Subtitle D Criteria for municipal solid waste landfills. The RIA evaluates the regulatory proposal relative to three alternatives in terms of costs, economic impacts, impacts on small entities, risk, and resource damage.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

3558 **(BR—85(7.19)) The ecology of the soft-bottom benthos of San Francisco Bay: A community profile.** Nichols, F.H.; Pamatmat, M.M. (Geological Survey, Menlo Park, CA (USA). Water Resources Div.; San Francisco State Univ., Tiburon, CA (USA). Tiburon Center for Environmental Studies). Sep 1988. 82p. US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89002501/JAW.

Benthic species composition in San Francisco Bay reflects the highly variable environment and the predominance of introduced species. Species abundances vary greatly with season, reflecting both intrinsic (reproduction/mortality) and extrinsic (salinity, sedimentation, wind) factors. Larger year-to-year variations appear associated with climatic patterns and unusual climatic events. Filter feeders predominate, with growth in some species linked to the availability of microalgae. They may prevent the growth of nuisance algal blooms. Benthic invertebrates are, in turn, food for fish, aquatic birds, and humans. Sediments and organisms are contaminated with wastes, but effects at the population level (declines in abundance) or community level (changes in species composition) are not easily distinguished from natural variability. Permanent effects of freshwater diversion or dredging on benthic community structure have not been detected. Shellfish harvesting, once commercially prominent, is restricted to sports digging of two introduced clam species. The renewal of commercial oyster growing, now being considered, requires resolution of contamination issues. The future management of the estuary's benthic resources depends on increased awareness of the need to protect and enhance these resources, on increased commitments to estuarine research, and on improved strategies for overcoming human-induced problems. 214 refs., 38 figs., 4 tabs.

3559 **(IAEA-R—3976-F) Evaluation of the operation of Yermasoyia surface and groundwater reservoirs. Final report for the period December 1984 - September 1987.** Iacovides, I.S. (Ministry of Agriculture and Natural Resources, Nicosia (Cyprus). Dept. of Water Development). (International Atomic Energy Agency, Vienna (Austria)). Jul 1988. 130p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704185/JAW.

The environmental isotope technique has been used in conjunction with hydrochemical methods to study the conjunctive use of surface and groundwater in the Yermasoyia area of Cyprus. The isotopes used in this study are /sup 18/O, /sup 2/H and /sup 3/H. The isotopically enriched water in the Yermasoyia dam is released periodically in order to study the movement of the released water. From the stable isotopes and tritium data, it became evident that two regions can be distinguished in the aquifer, the Upper part and the Delta area. The secondary aquifer on either side of the river valley does not appear to receive any water from the seepage of the dam. The overall tracer average velocity in the aquifer was computed to be 16+-3m per day and this is equivalent to a permeability of 160m per day. Water bodies originating from low frequency spills have been identified at the coast on the basis of oxygen-18 and tritium. A successful simulation of the reservoir for 1985 increased the confidence in the water balance and was used to verify the quantities estimated for evaporation and seepage. Refs, figs and tabs.

3560 **(PB—88-249008/XAB) Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 56.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Jul 1988. 589p. NTIS, PC A25/MF A01.

See also PB—88-249016 through PB—88-249057 and PB—87-198867.

Contents include: seal, sea lion, walrus and beluga whale surveys of the Bering Sea, 1979 and 1982-1983; investigations of belukha whales in coastal waters of western and northern Alaska. i. distribution, abundance, and movements; investigations of belukha whales in coastal waters of western and northern Alaska. ii. biology and ecology; investigations of belukha whales in coastal water of western and northern Alaska. iii. food habits; behavioral responses of gray whales to industrial noise: feeding observations and predictive modeling.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 2765, 2899, 3263, 3272, 3513, 3520, 3532, 3534, 3542, 3544, 3545, 3547, 3548

3561 **(AD-A—196280/2/XAB) Desktop techniques for analyzing surface-ground water interactions. The Reelfoot Lake case study. Research document.** McLaughlin, D.B. (Hydrologic Engineering Center, Davis, CA (USA)). May 1988. 98p. (HEC—28). NTIS, PC A05/MF A01.

This report is intended to illustrate how simple desktop analyses can be used to investigate complex hydrologic systems. The discussion focuses on a case study of Reelfoot Lake, Tennessee, a shallow eutrophic lake plagued by a number of water-quality problems. These problems are related, a least in part, to activities in the tributary watershed. The Reelfoot Lake watershed extends from an upland region which supplies most of the runoff, and probably most of the nutrient, entering the lake, to a lowland region which was historically part of the Mississippi River flood plain. Levees, drainage projects, and spillways have altered the watershed's hydrology and have complicated the lake's management. Since hydrologic data are limited and generally not very reliable, the processes that control the flow of water to and from the lake are not well understood. Some of the major questions about the region's hydrology need to be resolved before the agencies responsible for the lake can develop effective long-term management plans. The Reelfoot Lake case study offers a good opportunity to explore the advantages and disadvantages of simple desktop approaches to hydrologic analysis. We are particularly interested here in the way that desktop methods help reveal data gaps and uncertainties that tend to be obscured in more-elaborate computer-modeling studies. The author is also in-

terested in the qualitative conceptual issues that must be addressed in the beginning of any real-world hydrologic study, desk-top or computerized.

3562 **(AD-A—196352/9/XAB) Installation-restoration program records search for McEntire Air National Guard Base, Eastover, South Carolina.** (Hazardous Materials Technical Center, Rockville, MD (USA)). Jan 1984. 156p. NTIS, PC A08/MF A01.

Information obtained through interviews with 23 past and present base personnel, review of base records, and field observations indicate that small quantities of hazardous wastes have been disposed of on McEntire ANG Base property. No evidence of off-base environmental stress was observed, resulting from either past waste-disposal practices or waste spillage at McEntire ANG Base. No direct or indirect evidence of groundwater contamination was discovered. The identified waste disposal/spill sites are confined to a relatively small area of McEntire ANG Base and are generally aligned in directions nearly parallel to the anticipated direction of shallow ground-water flow. It is highly unlikely that any of the base activities have resulted in contamination of any off-base ground-water supplies obtained from the deep aquifer. Rather than monitoring each of the six spill/disposal sites previously identified, only four monitoring locations requiring four wells each are initially recommended for monitoring.

3563 **(AD-A—196355/2/XAB) US Air Force installation-restoration program. Phase 1. Records search. Air National Guard, Camp Edwards (ARNG), US Air Force and Veteran's Administration facilities at Massachusetts Military Reservation, Massachusetts. Task 6. Final report.** (Oak Ridge National Lab., TN (USA)). 11 Dec 1986. 217p. NTIS, PC A10/MF A01.

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste-disposal practices and to assess the potential for contaminant migration from these sites. The conclusions are based on the evaluation of information collected from the project team's field inspection; review of records and files; examination of historical aerial photographs; and interviews with base personnel, past employees, and state and local government employees. Sixty-one potential contamination sources were identified on ANG, Camp Edwards/ARNG, USAF, and VA facilities at MMR. These sites are identified, their evaluation summarized and locations shown. Forty-six of the 61 sites were determined to have a potential for contamination and contaminant migration.

3564 **(PB—88-239876/XAB) Effects of the 1980 eruption of Mount St. Helens on the limnological characteristics of selected lakes in western Washington. Water resources investigations.** Embrey, S.S.; Dion, N.P. (Geological Survey, Tacoma, WA (USA). Water Resources Div.). 1988. 68p. (USGS/WRI—87-4263). NTIS, PC A04/MF A01.

The 1980 eruption of Mount St. Helens, Washington, afforded an opportunity to study its physical, chemical, and biological effects on lakes near the volcano and to describe two newly created lakes. From June 1980 to August 1982, water samples were collected from four lakes in the blast zone and two outside the blast zone, as well as from the two newly created lakes. Concentrations of chemical constituents were inversely related to the distance of a lake from the volcano. The recovery of physical, chemical, and biological characteristics of the lakes will depend on stabilization of the volcano and lake watersheds, dilution and water-exchange rates, and biological processes within each lake. Excluding Spirit Lake from consideration, it was estimated from the study that St. Helens Lake would be the slowest of the study lakes to recover, and Venus Lake would be the fastest.

3565 **(PB—88-240429/XAB) Statewide survey of aquatic ecosystem chemistry, 1986. Final report.** McCleneghan, K.; Imai, R.H.; King, J.T.; Boggs, S.J. (California State Dept. of Fish and Game, Rancho Cordova (USA). Fish and Wildlife Water Pollution Control Lab.). Sep 1987. 85p. (LAB—86-5). NTIS, PC A05/MF A01.

See also report for 1985, PB—88-124995.

This study is one of the ecosystem surveys conducted as part of the Kapiloff Acid Deposition Research and Monitoring Program. Fifty lakes and streams throughout California were sampled during spring and fall 1986. The chemical characterization of surface waters was a continuation of work begun in 1985. Most of the lakes sampled were located at high elevation in the Sierra Nevada, the northeastern and northwestern regions of California. The report includes a listing of data collected in 1985-86, a description of methods and a list of lake and stream locations. Most lakes sampled had low alkalinity (<50 meq/l), low conductivity, and low ionic strength. Lakes in Southern California coastal locations are well-buffered and therefore not susceptible to damage due to acid deposition.

3566 **(PB—88-242573/XAB) Hydrologic-hydrochemical characterization of Texas Gulf Coast saline formations used for deep-well injection of chemical wastes. Final report, January 1987-July 1988.** Kreitler, C.W.; Akhter, M.S.; Donnelly, A.C.A. (Texas Univ., Austin (USA). Bureau of Economic Geology). Aug 1988. 219p. NTIS, PC A10/MF A01.

About 70% of the Class I injection wells in the United States are located in the Gulf Coast. This report presents the results of investigations into fluid-migration potential, direction, and velocities in the regional hydrologic environment of the Texas Gulf Coast Tertiary formations, and geochemical interactions that may be occurring. The study focused on the Frio Formation as it is the target of a very large waste-injection volume as well as a large data base of formation pressures and water chemistry.

3567 **(PB—88-242987/XAB) Changes in water quality and climate after forest harvest in central Washington state. Forest Service research paper.** Fowler, W.B.; Anderson, T.D.; Helvey, J.D. (Forest Service, Portland, OR (USA). Pacific Northwest Research Station). Jan 1988. 19p. (FSRP-PNW—388). NTIS, PC A03/MF A01.

Chemical output of nitrate, calcium, magnesium, sodium, potassium, and organic nitrogen were determined on a grams-per-hectare-per-day basis for five treatment watersheds and a control watershed. Water samples were collected from April to October during 3 pretreatment and 3 post-treatment years (1978 to 1983). Except for increased calcium and sodium in several streams, regression equations comparing treatment with control showed significant difference for pretreatment and posttreatment output. Output generally declined in the post-treatment years. Cyclic changes in output from these and other streams in the eastern Cascade Range in Washington appeared to occur regardless of treatment and were probably related to precipitation. Mean maximum air temperature increased during the posttreatment period in all the small watersheds, but stream temperatures were relatively unaffected.

3568 **(PB—88-243860/XAB) Health-hazard evaluation of waste water using bioassays: preliminary concepts.** Easterly, C.E.; Glass, L.R.; Jones, T.D.; Owen, B.A.; Schenley, R.L. (Oak Ridge National Lab., TN (USA). Health and Safety Research Div.). Aug 1988. 118p. NTIS, PC A06/MF A01.

Effluents from waste-water treatment facilities are discharged as a complex mixture of numerous chemical substances, which may include cytotoxic, carcinogenic, and mutagenic compounds. Historically, Federal and State Agencies have relied upon chemical-based analyses to set and enforce regulatory limits for these effluents. One problem with the approach is that many potentially hazardous chemicals may not be quantifiable in complex chemical effluents but are none the less discharged into the environment. The U.S. Environmental Protection Agency has recently established a research program to determine if a bioassay approach for evaluating the potential adverse human health effects from exposure to complex mixtures might supplement conventional chemical analysis for setting regulatory limits for waste-waters. This report summarizes a bioassay testing strategy for characterizing cytotoxic and mutagenic activity of various waste-water effluents. The use of a relative potency framework for assessing complex mixtures for potential health hazards is addressed.

3569 **(PB—88-243886/XAB) Survey and evaluation of fine-bubble dome and disc-diffuser aeration systems in North America. Final report, 1 September 1982-1 October 1983.** Houck, D.H. (Houck (D.H.) Associates, Inc., Silver Spring, MD (USA)). Aug 1988. 112p. NTIS, PC A06/MF A01.

The research project was undertaken with the overall objective of better defining the oxygen-transfer performance, operation and maintenance (O and M) requirements, and proper design approaches for ceramic fine-bubble dome and disc-diffuser aeration systems used in activated-sludge waste-water treatment. A study of dome and disc-diffuser aeration systems in 19 North American activated-sludge plants was carried out during the project. All were municipal waste-water treatment plants treating predominantly domestic wastes, though some had significant industrial flows as well. Data on design bases, influent and effluent wastewater characteristics, aeration power and air flow, and O and M experience were requested from each plant. These were supplemented as needed by on-site investigations and interviews that focused on the practical operating experience of plant personnel.

3570 **(PB—88-245923/XAB) National Stream Survey: Phase I field operations report.** Hagley, C.A.; Mayer, C.L.; Hoenicke, R. (Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV (USA)). 1988. 48p. NTIS, PC A03/MF A01.

See also PB—88-170840.

The National Stream Survey was conducted during the spring of 1986 as a synoptic chemical survey to characterize streams in the mid-Atlantic and southeastern regions of the United States which were thought to be potentially susceptible to acidic deposition. The survey included three distinct parts: a Phase I survey of streams in the mid-Atlantic region; a Screening survey designed to assess the need for future Phase I studies in the United States; and an Episodes Pilot survey designed to provide a preliminary assessment of the frequency, duration, and characteristics of storm episodes in the mid-Atlantic states. The report describes the survey planning, protocol development, personnel requirements, field operations, and logistical aspects of all three components of the National Stream Survey. Because of the large scope and geographical area covered by the survey, sampling regions were subdivided into four areas, each containing approximately the same number of streams. Samples were collected, shipped at 4°C, and received within 24 hours by a central processing laboratory. Sampling was completed on schedule, and 447 out of a total of 479 streams were sampled. A detailed evaluation of episodes sampling is provided with recommendations for future consideration.

3571 **(PB—88-245998/XAB) Ambient water-quality criteria for aluminum - 1988.** Brooke, L.T.; Stephan, C.E. (Environmental Protection Agency, Washington, DC (USA). Criteria and Standards Div.). Aug 1988. 56p. (EPA—440/5-86/008). NTIS, PC A04/MF A01.

This document provides a survey of literature related to the toxicity of aluminum to aquatic organisms, and a derivation of ambient water-quality criteria for the protection of freshwater aquatic organisms. The criteria are limited to a pH range between 6.5 and 9.0, and are given as a four-day average concentration, which should not exceed 87 microgram/L more than once in three years on the average, and a one-hour average concentration, which should not exceed 750 microgram/L more than once in three years, on the average. Specific instructions are given on the implementation of these criteria, with optional modification of the acid-soluble analytical methodology. A complete bibliography is included.

3572 **(PB—88-869540/XAB) Waste-water treatment: chemical industry. January 1970-September 1988 (Citations from Pollution Abstracts). Report for January 1970-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 108p. NTIS PC N01/MF N01.

Supersedes PB—87-860011.

This bibliography contains citations concerning waste-water treatment in the chemical industry relative to a wide variety of industrial pollutants. Biological treatments including carbon additives are described relative to effectiveness. The removal of mercury and its compounds are included, as well as associated problems and recommendations from fertilizer and pesticide pollution. (This updated bibliography contains 287 citations, 51 of which are new entries to the previous edition.)

3573 **(PB—88-869664/XAB) Heavy metals in drinking water: standards, sources, and effects. January 1978-September 1988 (Citations from the Life Sciences Collection data base). Report for January 1978-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 49p. NTIS PC N01/MF N01.

Supersedes PB—87-851960.

This bibliography contains citations concerning the public-health aspects and documented studies of heavy-metal pollutants in drinking water. Topics include human-exposure studies and the toxicological effects incurred by ingestion. Prolonged exposure and quantification factors and effects, federal and state regulations and standards, and laboratory-animal studies are discussed. Sources from landfill contamination of ground water, acid-precipitation contributions to ground-water pollution, and corrosion by-products in residential plumbing and public water supply transport systems are examined. (This updated bibliography contains 96 citations, 12 of which are new entries to the previous edition.)

3574 **(UCRL—21008-Vol.2-Pt.1) Evaluation of military field-water quality: Volume 2, Constituents of military concern from natural and anthropogenic sources: Part 1, Organic chemical contaminants.** Layton, D.W.; Mallon, B.J.; McKone, T.E.; Ricker, Y.E.; Lessard, P.C. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 123p. NTIS, PC A06/MF A01. Order Number DE89002654/JAW.

In this part of Volume 2 we focus on the identification and analysis of organic water contaminants that could degrade the performance of military personnel that drink field water. To identify the contaminants of concern, we developed a screening methodology for comparing measured concentrations of organic solutes in US and foreign surface and ground waters against estimated threshold concentrations for toxic and organoleptic effects. If the measured concentration of a substance in water was higher than the concentration used as an effects threshold for toxic or organoleptic responses, we then closely examined the substance's occurrence and toxicity to decide on recommending development of a water standard to protect military personnel from adverse health effects. After comparing the measured concentrations with the threshold concentrations for toxic or organoleptic effects, we concluded that there was only a small probability that troops would experience performance-degrading effects as a result of drinking field water containing organic solutes. However, we identified several organic solutes that could cause taste and odor problems. These compounds include trichloromethane, ethylbenzene, toluene, tetrachloroethene, and chlorinated phenols. Additionally, geosmin and 2-methylisoborneol, which are two metabolites of blue-green algae (cyanobacteria) and associated gram-negative filamentous bacteria (actinomycetes), can produce taste and odor problems and are of particular concern, especially when algal blooms are present. Oil and grease could also impair the potability of water supplies, and by fouling reverse-osmosis (RO) membranes, oil and grease could impair the performance of reverse osmosis water purification units (ROWPUs). 30 refs., 5 figs., 17 tabs.

3575 **Comparison of groundwater pumping alternatives for mitigating an area contaminated with hazardous waste.** Tsai, S.Y.; Zielen, A.J. (Argonne National Lab., IL (US)). pp 121-132 of Geotechnical and geohydrological aspects of waste management. Accord, MA; A.A. Balkema Publishers (1986). (CONF-860205—).

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

Wastewaters in the cesspools and leaching pits and leachate generated by precipitation infiltrating through the waste piles have percolated into the sand and gravel aquifer that lies directly beneath CAAP and extends into the surrounding area. A contamination survey of the CAAP site and its vicinity was initiated by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) in 1981. The results of several field samplings and chemical analyses indicate that explosive compounds have contaminated the areal aquifer and migrated offsite. The water in several private

wells downgradient of the CAAP site has been contaminated by significant levels of the explosive compounds. Migration of the contaminants is expected to continue in the groundwater flow system, thereby affecting additional groundwater in the area. In order to control further migration of the contaminants, a groundwater restoration program was initiated by USATHAMA to study various groundwater management schemes. The objective of this study is to numerically simulate various groundwater pumping schemes and evaluate their effectiveness in controlling plume migration. The results will be used by USATHAMA as supporting information in their decision-making process regarding the selection of an appropriate approach for decontaminating the contaminated aquifer in the area near the CAAP site.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 2840, 2885, 2886, 2887, 2890, 2891, 2896, 2897, 3532, 3534, 3549, 3552

3576 **(DOE-RW—88.059) Comparison between pathlines computed by NAMMU and an analytical solution - HYDROCOIN level 3-Test case 7.** Miller, D.R.; Paige, R.W. (Atkins (W.S.) and Partners, Epsom (UK)). (Department of the Environment, London (UK)). Jul 1988. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755546/JAW.

HYDROCOIN is an international project for comparing groundwater flow models and modelling strategies. Level 3, case 7 investigates the sensitivity of pathlines to changes in grid size for the groundwater flow in the vicinity of a well. Calculations have been made on grids of increasing refinement and the results compared with analytical solutions. The results demonstrate that NAMMU can accurately predict pathlines provided that a fine grid and a sufficiently restrictive pathline accuracy parameter are used. Heads are accurately predicted on relatively coarse grids but refinement of the grid is required to obtain similar accuracy for velocities and pathlines.

3577 **(DOE-RW—88.062) NAMMU results for the regional groundwater flow in the Piceance Basin - HYDROCOIN Level 2-Test case 4.** Miller, D.R.; Paige, R.W. (Atkins (W.S.) and Partners, Epsom (UK)). (Department of the Environment, London (UK)). Jul 1988. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755547/JAW.

The HYDROCOIN project is an international collaborative venture for comparing groundwater flow models and modelling strategies. Level 2 of this project concerns the validation of models in order to test their ability adequately to represent reality. This report describes calculations for the regional groundwater flow in the Piceance Basin of northwestern Colorado. This region constitutes one of the few areas where low permeability rocks, similar to those likely to be used for repository sites, have been investigated by hydrogeologists.

3578 **(INIS-BR—1296) Isotopic study of the Bambui Calcareous ground water - Bahia, Brazil.** Gomes, F.V.M. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704536/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

5205 Site Resource And Use Studies

3579 **(DOE/ER/60340—4) [The role of zooplankton in the cycling and remineralization of chemical materials in the Southern California Bight]: California Basin Study: DOE west coast basin program: Progress report 4, [June 1987--June 1988].** Small, L.F.; Huh, Chih-An. (Oregon State Univ., Corvallis (USA). Coll. of Oceanography). Jun 1988. Contract FG05-85ER60340. 54p. NTIS, PC A04/MF A01. Order Number DE89002260/JAW.

The overall objective of our research, within the structure of the DOE CaBS (California Basin Study) program, is to understand the transport pathways and mass balances of selected metabolically active and inactive chemical species in the Santa Monica/San Pedro Basins. One focus of our study is to examine the role of zooplankton and micronekton in the cycling and remineralization of chemical materials in the Southern California Bight, with particular reference to C, N and certain radionuclides and trace metals. A second focus is to examine these same radionuclides and trace metals in other reservoirs besides the zooplankton (i.e., in seawater, sediment trap material and bottom sediments). Knowledge of the rates, routes and reservoirs of these nuclides and metals should lead to a cogent model for these elements in Santa Monica/San Pedro Basins. Our zooplankton C and N data, in conjunction with primary production, microbiological and sediment flux data from colleagues in the program, should also lead ultimately to a model of C and N cycling in the basins. 33 refs., 13 figs., 7 tabs.

3580 **(PB—88-244769/XAB) Fiscal Year 1987 program report: Vermont Water Resources Research Center.** McIntosh, A.W. (Vermont Univ., Burlington (USA). Vermont Water Resources Research Center). Jul 1988. 29p. NTIS, PC A03/MF A01.

See also PB—88-142773.

Both surface and groundwater issues were addressed in the FY87 Vermont Water Resources Research Center program. Two projects focused on ground water, with one assessing techniques for reducing nitrate contamination in agricultural areas and a second comparing techniques for monitoring microbial contamination. A third project considered the role of acid deposition in the fate of aluminum in soils and water, while the final effort focused on the relationship between phosphorus and stream algal communities.

5206 Regulations

REFER ALSO TO CITATION(S) 3553, 3554, 3555, 3655, 3656, 3657, 3658

3581 **(AD-A—196429/5/XAB) Water quality modeling of reservoir system operations using HEC-5.** Willey, R.G. (Hydrologic Engineering Center, Davis, CA (USA)). Sep 1987. 118p. (HEC—24). NTIS, PC A06/MF A01.

This training document was written to assist users of computer program HEC-5, Simulation of Flood Control and Conservation Systems, in water-quality applications. This document supplements the program Users Manual, which is the basic documentation for the program. In addition to a brief description of the water-quality version of the HEC-5 model, this document also includes descriptions of application procedure, data requirements, and example program input and output.

3582 **(PB—88-242649/XAB) Review of the RCRA (Resource Conservation and Recovery Act) Ground-Water Monitoring Technical Enforcement Guidance Document. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 24 Jun 1986. 51p. (SAB/EEC—86/007). NTIS, PC A04/MF A01.

See also PB—87-107751.

The Committee was requested by the Office of Waste Programs Enforcement (OWPE) to review its draft document entitled RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TGED). The document concerns the technical aspects of ground-water monitoring at Resource Conservation and Recovery Act (RCRA) facilities. The Committee concluded that TEGD document that is reviewed was badly needed and represented a good start for setting consistent standards for establishing and evaluating ground-water-monitoring efforts. The Committee concluded that the majority of the TEGD is technically sound, and it made a number of recommendations for improvement that are included in the report. The Committee also suggested that the Agency should emphasize that the TEGD is neither a regulation nor an engineering handbook, and that flexibility, highly trained and experienced personnel, and professional judgment should be used by both EPA and those implementing ground-water monitoring systems.

3583 **(PB—88-243951/XAB) Setting priorities: the key to nonpoint source control. Final report.** Maas, R.P.; Smolen, M.D.; Jamieson, C.A.; Weinberg, A.C. (North Carolina State Univ., Raleigh (USA)). Jul 1987. 63p. NTIS, PC A04/MF A01.

Guidance for states in setting up water-quality programs is given. Recommendations and procedures are presented to focus resources to limited areas to achieve visible water quality improvements in a reasonable timeframe. The document reviews priority setting for water resources, planning, and organization of watershed projects; includes watershed-level targeting.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 2763

3584 **(DOE/EA—0366) Rock Creek tower painting project: Environmental assessment.** (USDOE Bonneville Power Administration, Portland, OR). Oct 1988. 5p. NTIS, PC A02/MF A01. Order Number DE89003013/JAW.

Bonneville Power Administration (BPA) built a 500-kV line across Rock Creek, a Class I trout stream about 20 miles east of Missoula, MT. Two 190-foot towers rise on either side of the Rock Creek valley, and the line between is suspended 600 feet over the valley floor. The crossing poses a hazard to passing airplanes and disrupts the natural landscape. The area where the line crosses Rock Creek is prized for its scenic beauty. In response to public demand that BPA protect the visual beauty of this area, BPA painted the towers gray to blend them best in with their natural surroundings. The issue now is to decide between either two gray towers or two orange-and-white towers. The underlying need is to resolve the conflict of pilot safety against scenic intrusion. The proposed action is to paint the gray tower aeronautical orange and white. Alternatives are to paint the orange-and-white tower back to its original gray; or leave the dilemma unresolved (the "no-action" alternative). 9 refs., 3 figs.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

3585 **(PNL-SA—15914) Ecotoxicology: Behavior, exposure, and effects.** Gray, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 25p. (CONF-8810217—1). NTIS, PC A03/MF A01. Order Number DE89001995/JAW.

From 1. European conference on ecotoxicolity; Copenhagen, Denmark (16 Oct 1988).

Understanding the behavioral responses of aquatic organisms to toxicants is essential to predicting organism exposure and subsequent effects on survival and ecological success. Behavioral responses of aquatic organisms to environmental change can mitigate or exacerbate exposures. Often, however, predictions are based on bioassay-tolerance data on the effects of various contaminant increments above ambient and unsubstantiated assumptions of organism exposure. Studies at the Pacific Northwest Laboratory, USA, have evaluated fish response to thermal discharge, gas supersaturated water, water-soluble fractions of coal liquids, and other stresses. Approaches have included biotelemetry in the field, and avoidance/attraction and predator/prey studies in the laboratory. In most cases, fish avoided acutely lethal conditions, although they did not necessarily avoid conditions causing chronic effects (effects on growth, reproduction, etc.). Behavioral responses of fish to toxicants varied with species, natural schooling instincts and matrix of the contaminant. Results of these studies led to the conceptualization of a model that links toxicological and behavioral data and considers the influence of environmental and other variables (feeding, schooling, spawning, etc.) on fish response. Further development of this model will allow more realistic assessments than can presently be attempted using acute and chronic toxicity data alone. 63 refs., 6 figs., 1 tab.

5502 Biochemistry

REFER ALSO TO CITATION(S) 2908, 3614

3586 **(CONF-881054—23) Degradation of trichloroethylene and trans-1,2-dichloroethylene by a methanotrophic consortia in a trickle-type bioreactor.** Strandberg, G.W.; Donaldson, T.L.; Bolla, L.L.; Palumbo, A.V.; Eng, W. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89001696/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

A trickle-bed bioreactor containing a consortium of microorganisms utilizing methane as the primary carbon source was used to treat a synthetic groundwater containing trichloroethylene (TCE) and trans-1, 2-dichloroethylene (DCE). With influent concentrations of TCE and DCE of 1 mg/L each and an average residence time of about 50 min, >50% of the TCE and >90% of the DCE was degraded. The reactor exhibited first-order kinetics with respect to TCE degradation. 5 refs., 1 tab.

3587 **(IPEN-Pub—158) Recovery of high purity proteins from polyacrylamide gels using ultraviolet scanning densitometry.** Bartolini, P.; Arkaten, R.; Ribela, M.T.C.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704277/JAW.

We present here a technique for the purification of proteins carried out by a quantitative analytical method used in conjunction with a preparative gel electrophoresis. Both methods employ densitometric ultraviolet scanning of unstained protein bands, a procedure wich is particulary suitable for the purification and recovery of biologically active polypeptides. In short, the purified extracted protein, isolated in a segment cut out from a preparative gel, is recovered by a second (reversed) electrophoresis. We performed the extractions and recoveries of different amounts of two standard proteins (BSA and STI) and a polypeptide hormone (hGH). Our main interest, especially for the hormone is the complete protein recovery with retention of bio and immunoactivity and high purity. For the proteins tested, the mean recovery was of 93 /sup +/- 5% obtaining a mean purity of 95 /sup +/- 7%. We conclude that the proposed method should have interesting applications, particularly in the obtention of very pure hormones, as are needed for radioligand assays, for radiolabelling and specific antibody raising. We emphasize the simplicity and rapidity of the method (the entire preparative process: first electrophoresis, UV scanning and reversed electrophoresis can be performed in approximately six hours) and its efficiency in recovering pure protcins even on a milligram scale. We thank the support from the IAEA (4299/RB) and FINEP (43.86.0351.00) and CENE (Brazil).

3588 **(UCRL—98726) Analysis of cooked-food mutagens by HPLC/immunoassay.** Watkins, B.E.; Vanderlaan, M.; Felton, J.S. (Lawrence Livermore National Lab., CA (USA)). 10 Oct 1988. Contract W-7405-ENG-48. 10p. (CONF-8810209—1). NTIS, PC A03/MF A01. Order Number DE89001509/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

Recognizing that an immunoassay for these aminoimidazoazaarenes (AIAs) could be an analytical method with higher sample throughput and would be less costly, we developed a set of monoclonal antibodies that selectively bind to each of the AIAs. We selected PhIP (6-phenyl-2-amino-1-methylimidazo[4,5-b]pyridine) for the initial assay development because it is the AIA that is most abundant by mass in cooked meat and it is the most genotoxic AIA in mammalian-cell short-term bioassays. It is, however, the least active AIA in the Ames Salmonella mutagenesis assay. We have recently developed a set of four monoclonals that bind to the PhIP. These antibodies were produced by standard methods and were derived from the immunogen described previously. The binding speci-

ficity of each of these antibodies has been well characterized. The most specific antibody, called PhIP-1, will bind PhIP with a 50% inhibition point (I_{50}) of 30 ng, and it will not bind to any of the other AIA mutagens, nor to any of a number of synthetically produced derivatives of PhIP, such as Iso-PhIP (6-phenyl-2-amino-3-methylimidazo[4,5-b]pyridine). PhIP-1 does bind with 2-deamino-PhIP and 2-deamino-2-nitro-PhIP with an I_{50} of 13 and 16 ng, respectively. 9 refs., 3 figs.

3589 **(UCRL—98801) A recombinant DNA method for understanding the mechanism of Salmonella reverse mutations: Role of repair.** Felton, J.S.; Wu, R.; Shen, N.H.; Healy, S.K., Fuscoe, J.C. (Lawrence Livermore National Lab., CA (USA); Connecticut Univ., Storrs (USA). Center for Environmental Health). Oct 1988. Contract W-7405-ENG-48. 10p. (CONF-8810209—4). NTIS, PC A02/MF A01. Order Number DE89002275/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

This is a report of an investigation of the specific changes in the DNA of Salmonella revertants induced by environmental mutagens and their metabolites. These compounds were chosen because they specifically induce frameshift lesions in strains TA1538 and TA98. DNA lesions in these strains are analyzed in the hisD gene and can lead to reversion of histidine dependence by either deletions, insertions, or suppressor mutations. The understanding of the types of DNA-base changes induced by both a mutagen and its metabolites can lead to a better understanding of not only the mutational process and repair mechanisms, but also the potency and mode of action of specific metabolites and their corresponding DNA adduct(s). The detailed developed of the methods used for this research and the original findings with benzo[a]pyrene have been recently published. 4 refs., 2 figs.

3590 **(UCRL—98935) Human DNA repair and recombination genes.** Thompson, L.H.; Weber, C.A.; Jones, N.J. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 21p. (CONF-8810220—1). NTIS, PC A03/MF A01. Order Number DE89001122/JAW.

From North Atlantic Treaty Organization advanced research workshop on DNA repair mechanisms and their biological implications in mammalian cells; Fontevraud, France (2 Oct 1988).

Several genes involved in mammalian DNA repair pathways were identified by complementation analysis and chromosomal mapping based on hybrid cells. Eight complementation groups of rodent mutants defective in the repair of uv radiation damage are now identified. At least seven of these genes are probably essential for repair and at least six of them control the incision step. The many genes required for repair of DNA cross-linking damage show overlap with those involved in the repair of uv damage, but some of these genes appear to be unique for cross-link repair. Two genes residing on human chromosome 19 were cloned from genomic transformants using a cosmid vector, and near full-length cDNA clones of each gene were isolated and sequenced. Gene ERCC2 efficiently corrects the defect in CHO UV5, a nucleotide excision repair mutant. Gene XRCC1 normalizes repair of strand breaks and the excessive sister chromatid exchange in CHO mutant EM9. ERCC2 shows a remarkable {approximately}52% overall homology at both the amino acid and nucleotide levels with the yeast RAD3 gene. Evidence based on mutation induction frequencies suggests that ERCC2, like RAD3, might also be an essential gene for viability. 100 refs., 4 tabs.

3591 **(UCRL—99416) Use of fluorescence in situ hybridization to detect and monitor transfected and amplified sequences in recombinant CHO cells.** Pallavicini, M.G.; DeTeresa, P.S.; Wurm, F.M. (Lawrence Livermore National Lab., CA (USA); Genentech, Inc., San Francisco, CA (USA)). 4 Aug 1988. Contract W-7405-ENG-48. 20p. (CONF-8805202—1). NTIS, PC A03. Order Number DE89001433/JAW.

From Conference on continuous cell lines as substrates for biologicals; Arlington, VA, USA (26 May 1988).

Fluorescence In Situ Hybridization (FISH) can be used routinely to detect and monitor foreign DNA sequences in recombinant mammalian cells. Non-radioactive hybridization and detection of foreign DNA can be performed within 1-2 days, in contrast to weeks often required for autoradiographic analysis. Since cells can be evaluated on an individual basis, cell-to-cell variation in integration patterns of foreign DNA in populations of cells can be assessed. The effects of culture conditions on DNA integration patterns are also easily monitored by FISH. FISH technology is a useful tool, therefore, for monitoring of foreign genes in recombinant mammalian cells. Further improvements of the method and accumulation of more data from cells grown in and selected for various concentration of MTX will allow us to achieve a better understanding of the mechanisms responsible for integration and amplification of transfected DNA in CHO cells. 16 refs., 5 figs.

5503 Cytology

REFER ALSO TO CITATION(S) 3614, 3649

3592 **(BNL—41820) Recent developments in blood cell labeling research.** Srivastava, S.C.; Straub, R.F.; Meinken, G.E. (Brookhaven National Lab., Upton, NY (USA)). 7 Sep 1988. Contract AC02-76CH00016. 31p. (CONF-8805211—1). NTIS, PC A03/MF A01. Order Number DE89001609/JAW.

From 12. Sigrid Juselius Foundation symposium on tracers in diagnostic imaging; Helsinki, Finland (22 May 1988).

A number of recent developments in research on blood cell labeling techniques are presented. The discussion relates to three specific areas: (1) a new in vitro method for red blood cell labeling with /sup 99m/Tc; (2) a method for labeling leukocytes and platelets with /sup 99m/Tc; and (3) the use of monoclonal antibody technique for platelet labeling. The advantages and the pitfalls of these techniques are examined in the light of available mechanistic information. Problems that remain to be resolved are reviewed. An assessment is made of the progress as well as prospects in blood cell labeling methodology including that using the monoclonal antibody approach. 37 refs., 4 figs.

3593 **(PB—88-234406/XAB) Biochemical and metabolic response to nitrogen dioxide-induced endothelial injury. Research report, April 1983-January 1987.** Patel, J.M.; Block, E.R. (Health Effects Inst., Cambridge, MA (USA)). Jun 1987. 33p. (HEI/RR—87/09). NTIS, PC A03/MF A01.

See also PB—88-234398.

This study used tissue culture monolayers of porcine pulmonary artery and aortic endothelial cells to investigate the effects of 3 and 5-ppm nitrogen dioxide (NO_2) on cell membranes. Biophysical changes in the membrane preceded, by many hours, the metabolic uptake and biochemical and enzymatic changes in the cell. Membrane fluidity was found to be reduced in both hydrophobic and hydrophilic regions of the plasma membrane after three hours of exposure. This was accompanied by an increase in lipid content in the membrane. After 24 hours of exposure, NO(2-) induced injury was observed, with a decreased uptake of 5-hydroxytryptamine and an increase in lactate dehydrogenase release. Other effects observed include an increase in lipid peroxide formation and an increase in antioxidant enzyme activities. It was found that all abnormal biochemical and biophysical changes induced by NO_2 exposure were reversed 24 to 48 hours after exposure.

3594 **Monoclonal antibodies to human hemoglobin S and cell lines for the production thereof.** Jensen, R.H.; Vanderlaan, M.; Bigbee, W.L.; Stanker, L.H.; Branscomb, E.W.; Grabske, R.J. (to Dept. of Energy, Washington, DC). US Patent 4,752,583. 21 Jun 1988. Filed date 29 Nov 1984. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A hybridoma identified as Hu S-1 or HB-8660, which produces monoclonal antibodies which react selectively with human hemoglobin S is described.

5505 Metabolism

REFER ALSO TO CITATION(S) 2753, 2754, 3640, 3653, 3668

5506 Medicine

REFER ALSO TO CITATION(S) 3290, 3292, 3614, 3630, 3636

3595 **(AD-A—196948/4/XAB) Speed of estimation in positron emission tomography.** Johnstone, I.; Silverman, B.W. (Stanford Univ., CA (USA)). 1987. 45p. NTIS, PC A03/MF A01.

Several algorithms for image reconstruction in positron emission tomography (PET) have been described in the medical and statistical literature. A continuous idealization of the PET reconstruction problem is studied, considered as an example of bivariate density estimation based on indirect observations. Given a large sample of indirect observations, the size is considered of the equivalent sample of observations, whose original exact positions would allow equally accurate estimation of the image of interest. Both for indirect and for direct observations, the exact minimax rates are established for convergence of estimation, for all possible estimators, over suitable smoothness classes of functions. For indirect data and (in practice unobservable) direct data, these rates are n exp(-p/(p+2)) and (n/log n) exp(-p/(p+1)) respectively, for densities in a class corresponding to bounded square-integrable pth derivatives. Numerical values are obtained for equivalent sample sizes for a particular class of orthogonal series estimators, based on the eigenfunctions of the Radon transform.

3596 **(BNL—41906) Microimaging studies of myocardial substrate utilization and perfusion in two models of non-coronary heart disease.** Som, P.; Oster, Z.H.; Knapp, F.F. Jr. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016;AC05-84OR21400. 19p. (CONF-8711198—2). NTIS, PC A03. Order Number DE89002907/JAW.

From International symposium on the use of radioiodinated free fatty acids; Amsterdam, Netherlands (26 Nov 1987).

We have studied two animal models of non-coronary heart disease. The salt-sensitive Dahl strain hypertensive rats and their genetically matched normotensive controls and the cardiomyopathic BIO 53.58 (CM) strain Syrian hamsters with age and sex-matched RB strain controls. The CM strain hamster seems to be a very good model of human congestive cardiomyopathy and the Dahl strain hypertensive rats have also been found to be good models for studying the effects of hypertension on the myocardium. In our studies we compared the utilization of various metabolic substrates, viz., fatty acids, glucose analogs, and the early distribution of ^{201}Tl, as an indicator of myocardial flow. The routine studies involving dissection of animals for assaying the radioactivity following the injection of radiopharmaceuticals is not suitable for assessing regional changes in metabolism and flow. The use of quantitative autoradiographic microimaging (ARG) enables the visualization of discrete regional as well as global changes from normal and to quantitate them. This paper describes the methodology and results of these investigations. 14 refs., 5 figs.

3597 **(IC—88/29) Mathematical model for hypothalamus-hypophysis-adrenal cortex system.** Zhang Xianwei. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704693/JAW.

Under certain assumptions we set up a mathematical model for the hypothalamus-hypophysis-adrenal cortex system as a self-regulative system to study the dynamics of this system and to explain the clinical observations by the model equations. Some predictions of this model will be checked by future experiments. (author). 5 refs, 6 figs.

3598 **(INIS-BR—1325) Xeroradiography.** Farias, J.T. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 8p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704784/JAW.

The xeroradiography as an electrostatic radiographic method using a selenium plate is described. Some advantages and disadvantages of the xeroradiography method are presented with their main applications. (C.G.C.).

3599 **(INIS-BR—1330) Mammography.** Oliveira, S.B. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 24p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704789/JAW.

The mamma anatomy are showed with the main characteristics for the mamography examination. The energy band, the additional filtration, the half-value thickness are also mentioned. The evaluation in the exposure and the doses in the mamography examination are described with a quality control for obtention the best image. (C.G.C.).

3600 **(IPEN-Pub—176) Biodistibution of 2,6 diisopropyliminodiacetic acid /sup 99m/Tc (Disida-/sup 99m/Tc) in normal rats and with experimental hepatic lesion.** Colturato, M.T.; Muramoto, E.; Hamada, E.S.; Barbosa, M.R.F. de; Herrerias, R.; Silva, C.P.G. da. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 15p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704282/JAW.

The biodistribution and elimination of /sup 99m/Tc-DISIDA were examined by performing scintigrams on rats at different times. Normal animals (rats) and those with experimental hepatobiliary alterations were used. Results showed a delayed clearance of /sup 99m/Tc-DISIDA into the small intestine of the experimental animals. The elimination of the labelled compound by the kidney was 14% dose/g 120 minutes after the injection of which 70% was found in its original form. The data indicate that in spite the compound is intact in bile it undergoes a degradative process, not yet known.

3601 **(IPEN-Pub—178) Preparation of /sup 99m/Tc-Tin colloid: a freeze-dried kit for liver imaging.** Hamada, E.S.; Muramoto, E.; Barbosa, M.R.F. de; Colturato, M.T.; Herrerias, R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 13p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704283/JAW.

/sup 99m/Tc-tin-colloid was formulated as a useful agent for liver imaging. The radiochemical purity and stability of the labeled colloid were determined by paper chromatography and 85% methanol solvent, the labelling efficiency was > 95%. The comparative studies of the biological distribution of /sup 99m/Tc-tin-colloid and /sup 99/Tc-sulphur-colloid were made with Wistar rats. The results of organ distribution were similar in both products; > 90% liver uptake.

3602 **(LA-UR—88-3590) Mathematical models of the AIDS epidemic: An historical perspective.** Stanley, E.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-8807127—1). NTIS, PC A03/MF A01. Order Number DE89002295/JAW.

From Lectures in complexity; Santa Fe, NM, USA (1 Jul 1988).

Researchers developing mathematical models of the spreading of HIV, the Human Immunodeficiency Virus that causes AIDS, hope to achieve a number of goals. These goals may be classified rather broadly into three categories: understanding, prediction, and control. Understanding which are the key biological and sociological processes spreading this epidemic and leading to the deaths of those infected will allow AIDS researchers to collect better data and to identify ways of slowing the epidemic. Predicting the groups at risk and future numbers of ill people will allow an appropriate allocation of health-care resources. Analysis and comparison of proposed control methods will point out unexpected consequences and allow a better design of these programs. The processes which lead to the spread of HIV are biologically and sociologically complex. Mathematical models allow us to organize our knowledge into a coherent picture and examine the logical consequences, therefore they have the potential to be extremely useful in the search to control this disease. 24 refs., 3 figs.

3603 **(NAC—86-08) Pretoria fast neutron therapy facility.** Hough, J.H.; Binns, P.J. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Accelerator Centre). Jul 1986. 24p. CSIR, National Accelerator Centre, P O Box 72, Faure, 7131, South Africa.

The extraction system of the National Accelerator Centre cyclotron in Pretoria has been modified to deliver high intensity deuteron beam currents for radiation therapy. A fast neutron field is generated via the d(16) + Be reaction on a thick target and is collimated by a variable field size collimator. Absorbed dose measurements were performed using a 0,5 cm/sup 3/ tissue-equivalent ionization chamber and an energy compensated Geiger-Muller tube. A total dose yield of 0,51 cGy min/sup -1/ μA/sup -1/ with a photon component of 1,9% has been determined in air at an SSD of 135 cm. The prescribed patient dose is monitored by two identical transmission ionization chambers which form an integral part of a microprocessor controlled dose monitoring system. The beam characteristics measured in air and in a water phantom concur with data from other therapy centres with comparable neutron energies. A treatment regime of 1720 cGy (total dose) delivered in 8 fractions over 25 days is proposed.

3604 **(NAC—87-02) Initial commissioning tests of the NAC neutron therapy unit.** Jones, D.T.L.; Hendrikse, W.L.J.; Yudelev, M. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Accelerator Centre). 1987. 19p. the CSIR, National Accelerator Centre, P O Box 72, Faure, 7131, South Africa.

An isocentric neutron therapy treatment system has been installed at the NAC. The system utilizes the 66 MeV p/Be reaction for neutron production. An outline is given of the initial commissioning tests which were performed with a proton beam at currents of 1-12 μA. Several problems were encountered. It was found that the flattening filters had not been installed, the filter drawer assemby and the control logic did not operate properly. Some of the magnet power supplies were incorrectly wired and the pump for the target cooling system seized up. Where possible the faults were corrected. The flattening filters will be installed shortly as well as a beam scanner in the gantry which should greatly facilitate steering the proton beam onto the target. The measurements made of the neutron fields were satisfactory.

3605 **(NAC—87-04) Absolute dosimetry for neutron therapy.** Jones, D.T.L. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Accelerator Centre). [1987]. 17p. the CSIR, National Accelerator Centre, P O Box 72, Faure, 7131, South Africa.

The NAC has adopted the European protocol for dosimetry measurements in the p(66)/Be neutron therapy beam. The transmission ionization chambers in the treatment head are calibrated by measuring the total dose at a reference point in water with a tissue equivalent ionization chamber. Measurements with a Geiger-Mueller counter at the same point enable the separate neutron and gamma dose components to be determined. Details of the measurement procedures and methods of calculating the doses are presented.

3606 **(NAC—87-05) Principles of particle radiography and possible medical application.** Jones, D.T.L. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Accelerator Centre). [1987]. 19p. the CSIR, National Accelerator Centre, P O Box 72, Faure, 7131, South Africa.

Beams of neutrons from the p(66 MeV)/Be reaction and protons (up to 200 MeV) will be available at the NAC for medical applications. The principles of neutron and proton radiography are discussed. It is concluded that proton radiography may have some applications in the medical field while neutron radiography will be of little use.

5507 Microbiology

REFER ALSO TO CITATION(S) 2748, 2753, 2754, 2758, 3574, 3586, 3602

5509 Pathology

REFER ALSO TO CITATION(S) 2764, 3568, 3620, 3641, 3647, 3665

3607 **(PB—88-243308/XAB) Registry of toxic effects of chemical substances, 1975 edition.** Christensen, H.E.; Luginbyhl, T.T. (Tracor JITCO, Inc., Rockville, MD (USA)). Jun 1975. 1405p. NTIS, PC A99/MF E10.

See also PB—87-145017.

The 1975 Edition of the Registry of Toxic Effects of Chemical Substances, formerly known as the Toxic Substances List is the fourth revision of the list of toxic substances prepared at least annually in accordance with Section 20(a)(6) of the Occupational Safety and Health Act of 1970, Public Law 91-596. The Registry includes the original list published in June 1971 and the offerings of the subsequent publications. The Registry contains 64,300 listings of chemical substances: 16,500 are names of different chemicals with qualifying toxic dose information and 47,800 consist of synonymous names and codes which have been acquired from published literature, cooperating industries, and the American Chemical Society. The revision contains approximately 4,000 new compounds which had not appeared in the 1974 edition. The specific data provided on the toxicity of each substance related to: route of administration, animal species involved, type of exposure reported (e.g. lethal), dose which caused toxic response, and body system affected. The bibliographical sources from which the toxicity data were extracted are all listed. Absence of a substance does not imply that it is innocuous.

3608 **(PB—88-243316/XAB) Registry of toxic effects of chemical substances, 1977 edition. Volumes 1 and 2.** Fairchild, E.J.; Lewis, R.J.; Tatken, R.L. (Tracor JITCO, Inc., Rockville, MD (USA)). Sep 1977. 1963p. NTIS, PC A99/MF E15.

See also report for 1975, PB—88-243308.

This edition of the Registry of Toxic Effects of Chemical Substances was published in two volumes to accommodate the increased number of substances and toxicity citations, and to provide indexes to those subfiles containing substances of special interest. Rather than split the text arbitrarily, the authors included the indexes in Volume I and all toxicity data in Volume II. Volume I contains the Introduction and Appendixes and is divided into five chapters. Chapter one contains a complete alphabetical listing of all substance prime names and synonyms in the Registry. The remaining four chapters are indexes to the subfiles of those compounds with toxicity citations in the literature indicating carcinogenic and neoplastigenic, teratogenic, mutagenic, or human toxic effects. The Registry contains 98,993 listings of chemical substances. The 1977 Registry includes listings for over 4,700 new substances in addition to more than 8,000 new toxic dose data lines. This edition also includes citations for those substances being tested under the National Cancer Institute's carcinogenesis bioassay program, as well as references to comprehensive toxicity review articles located in the literature.

3609 **(PB—88-243324/XAB) Registry of toxic effects of chemical substances, 1980 edition. Volumes 1 and 2.** Lewis, R.J.; Tatken, R.L. (Tracor JITCO, Inc., Rockville, MD (USA)). Feb 1982. 2050p. NTIS, PC A99/MF E15.

See also report for 1977, PB—88-243316.

This is the 10th edition of the Registry of Toxic Effects of Chemical Substances. It was published in two volumes to accommodate the increased number of substances. All substance prime names and synonyms are listed in alphabetical order, and each synonym is cross-referenced to its appropriate prime name accession number. Volume I contains prime names and synonyms for substances beginning with A through I; Volume II contains those beginning with J through Z. This 1980 edition contains 168,096 listings of chemical substances: 45,156 are names of different chemicals with their associated toxicity data and 122,940 are synonyms. This

edition also contains approximately 5,900 new substances and 8,000 new toxicity data lines that did not appear in the 1979 Registry.

3610 **(PB—88-245527/XAB) Review of a health-assessment document for beryllium. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 24 Apr 1987. 9p. (SAB/EHC—87/028). NTIS, PC A02/MF A01.

See also PB—86-183944.

The Metal's Subcommittee agrees with the conclusions reached in the draft document concerning the evidence of carcinogenicity using epidemiological and animal data. The Subcommittee was unable to research a consensus on advising the Agency on the use of existing data to estimate an upper bound to human risk. In addition, the Subcommittee continues to disagree with the Agency's choice of a model for the pharmacokinetics of inhaled beryllium particulates. These and other issues are detailed in the report.

3611 **(PB—88-245535/XAB) Review of a draft health-assessment document for polychlorinated debenzofurans. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 16 Jan 1987. 7p. (SAB/EHC—87/021). NTIS, PC A02/MF A01.

The available information on polychlorinated dibenzofurans is scant. For this reason, staff utilized information about polychlorinated dibenzo-p-dioxins in the assessment. The scientific theory that supports the use of the analogy is sound. Both groups of substances are thought to cause biological effects by binding with different affinities to the same intracellular receptor molecule. However, the draft document assumes the theory for one plausible effect of receptor binding, namely developmental abnormalities, and not for other effects which have been attributed to polychlorinated dibenzo-p-dioxins in previous Agency assessments, such as carcinogenicity. The Subcommittee requests that EPA either assume the same theory for all effects or provide an explanation of why carcinogenic effects do not follow from binding to the receptor.

3612 **(PB—88-246947/XAB) Acrylonitrile pharmacodynamics and mutagenesis. Report for 1 July 1977-30 June 1979.** Wolff, M.S. (Mount Sinai School of Medicine, New York. Environmental Sciences Lab.). 1979. 10p. NTIS, PC A02/MF A01.

A study was made of the pharmacokinetics of acrylonitrile (AN) with emphasis on routes of elimination and mechanisms of metabolism. Rats were given intraperitoneal injections of AN at 5 to 60mg/kg. Two AN analogues, crotononitrile (CN) and methacrylonitrile (MN), were also studied. CN and MN concentrations in blood followed a first-order kinetic elimination. AN demonstrated a biphasic kinetic elimination. An was measurable in fat, liver, and blood for 18 hours after a 37mg/kg dose. Fecal excretion was significant at levels of 3 to 9 parts per million (ppm) at 3 hours after exposure. Urine levels of 0.03ppm were registered after 5.3mg/kg dose levels and 0.1ppm after 81mg/kg. Total AN in feces, urine and tissues even at very short intervals after intraperitoneal administration represented only 3 to 30% of the administered dose. The fast AN metabolic pathway was consistent with Michael addition to AN or its analogs and would readily account for cyanide formation.

3613 **(PB—88-247960/XAB) Mercury burden and health impairment in dental auxilaries. Final report.** Shapiro, I.M.; Bloch, P.; Ship, I.I.; Spitz, L.; Summer, A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 1988. 28p. NTIS, PC A03/MF A01.

An effort was made to develop a safe and effective x-ray fluorescence system for monitoring mercury and other elements in human tissues in-situ, to determine mercury levels in 207 dental auxiliaries exposed to dental amalgam on the job, to evaluate mercury in matching nonexposed populations and in 298 dentists using mercury amalgam, and to evaluate deficiencies in central and peripheral nervous systems resulting from the mercury exposure. Mercury levels were below 20 micrograms/gram in 60% of the dentists and 90% of the dental auxiliaries. Dentists with the higher mercury concentrations in their heads or wrists had considerably longer median motor distal latencies and median F-wave latency. Five of them demonstrated abnormalities consistent with carpal tunnel syndrome; seven had polyneuropathies defined as reduced motor or sensory conduction velocities of response amplitudes in two or more nerves. Neuropsychological tests indicated both groups of dental workers were adversely affected by mercury exposure.

5510 Physiological Systems

3614 **Theoretical immunology, Part 1: Part 1, Proceedings.** Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988). 404p. Addison-Wesley Publishing Company, 390 Bridge Parkway, Suite 202, Redwood City, CA 94065-1522. Order Number TI88010717/JAW. Contract FG04-87ER60560.

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

The immune system is complex system of cells and molecules distributed throughout our bodies. Analogies have been drawn between the immune system and the nervous system. The immune system performs pattern recognition tasks, learns and retains a memory of the antigens that it has fought. Interactions between these cells and molecules are slowly being elucidated. Theoretical ideas have played a major role in the development of the field. Controversies such as instructive vs. selective theories of antibody formation, germ-line vs. somatic mutation models for the generation of antibody diversity, and regulatory circuits vs. idiotypic networks have dominated both the intellectual development of the field and determined the direction of much experimental effort. Quantitative theories, have to date not been significant in the intellectual development of the field. This may be changing as the field addresses more quantitative issues such as the role of somatic hypermutation in the generation of antibody diversity, the role of receptor clusters in cell stimulation and desensitization, etc. Quantitative theories will also be essential for the development of global models of the immune system in which both the spatial and temporal aspects of humoral and cell-mediated responses are integrated into a single model, and may well be needed in order to understand the role of idiotypic networks in immune regulation.

5520 Public Health

REFER ALSO TO CITATION(S) 2781, 2798, 3502, 3505, 3507, 3508, 3509, 3510, 3521, 3522, 3574, 3607, 3608, 3609, 3612, 3613, 3636, 3653, 3659, 3660, 3662, 3672

3615 **(PB—88-236708/XAB) NIOSH (National Institute for Occupational Safety and Health) Occupational Safety and Health research and demonstration grants: fiscal year 1977-78.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1978. 128p. (DHEW/PUB/NIOSH—78-162). NTIS, PC A07/MF A01.

Also available from Supt. of Docs. See also PB—86-211364.

This report lists all research and demonstration grants bestowed by NIOSH during FY-1977/1978. Areas of research were awarded in 1977 included: (1) laboratory, clinical, and epidemiological investigations of occupationally derived diseases, pathological changes, and physiological and psychological alterations; (2) studies of psychologic and motivational factors in occupational situations and their impact on job satisfaction and performance; (3) studies of safety factors in work flow, plant design, work operations, man-machine interactions, and occupational environment; (4) health effects of mining and energy extraction, utilization, conversion, and transmission; (5) control methodologies and technologies for reduction or elimination of occupational hazards; (6) morbidity and mortality studies on humans exposed to occupational and industrial hazards; (7) workers adaptive mechanisms to occupational stress; and (8) studies on the nature of fatigue and its role in worker susceptibility to accidents and occupational illness.

3616 **(PB—88-237516/XAB) NIOSH (National Institute for Occupational Safety and Health) report on occupational safety and health for Fiscal Year 1986 under Public Law 91-596.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Sep 1987. 58p. NTIS, PC A04/MF A01.

See also report for 1984, PB—88-237508.

A brief review is provided of the development of the field of occupational safety and health in the United States for FY 1986. The tasks which NIOSH was mandated to carry out are briefly defined, and its activities in the areas of hazard identification, hazard evaluation, control systems, and dissemination of information are described. The organization of the Institute is delineated with explanations of activities given for each of its various divisions. Efforts are described in the areas of concern.

3617 **(PB—88-239603/XAB) NIOSH (National Institute for Occupational Safety and Health) certified equipment as of July 1, 1978.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1978. 95p. (DHEW/PUB/NIOSH—79-107). NTIS, PC A05/MF A01.

See also PB—87-104725.

This publication listed devices certified by NIOSH or by NIOSH and the Mine Safety and Health Administration. Types of items certified included coal-mine dust personal-sampler units, gas detector tube units, respiratory protective devices, self-contained breathing apparatus, gas masks, supplied air respirators, respirators for dust, fumes, and mist, and chemical-cartridge respirators. Names and addresses of distributors of the approved equipment were provided. The available test procedures were also listed. Sound-level meter sets and their manufacturers were listed along with test procedures used for industrial sound-level meter sets.

3618 **(PB—88-247069/XAB) Minimizing occupational exposure to pesticides.** Davies, J.E.; Freed, V.H. (Miami Univ., Coral Gables, FL (USA). School of Medicine). 1976. 22p. NTIS, PC A03/MF A01.

See also PB—81-231680.

An epidemiological overview was presented of occupational pesticide exposure, breaking the subject into three major areas: types of exposure and population at risk, health-related effects, and exposure-assessment measures. Acute and chronic exposures to pesticides were of concern, with systemic poisonings, and topical effects on the skin and eyes being the most common illnesses reported. The population at risk included those involved with the manufacture, application, formulation, mixing and loading, and picking and thinning. The health significance of pesticide exposure has become more widely understood as effects such as male sterility, neurological and renal disease, cancer and teratogenic effects and behavioral disorders have been associated with these chemicals. Several studies have been concerned with improving the means of monitoring worker exposure. The effects of the use of protective clothing on worker exposure have been investigated.

3619 **(PB—88-247655/XAB) Anesthetic exposure and health of dental personnel, 1 June 1978-30 November 1980.** Cohen, E.N. (Stanford Univ., CA (USA). Dept. of Anesthesia). 1980. 6p. NTIS, PC A02/MF A01.

An epidemiologic survey was conducted to determine possible health hazards in the dental profession, with particular attention being given to the results of exposure to anesthetic gases. The survey contacted 30,650 dentists and 30,547 chairside assistants who were subsequently grouped according to exposure to inhalation anesthetics in the dental operatory during the course of their employment experience. An increase in liver disease 1.7 above that expected was noted in male dentists heavily exposed to anesthetics, combined with a 1.2 fold increase for kidney disease and 1.9-fold increase for neurological disease. The spontaneous abortion rate in wives of male dentists was 1.5-fold higher than expected. Occupational exposure to anesthetics, either direct or indirect, was associated with significant increases in spontaneous abortion over control levels during the first and second trimester of pregnancy. Women who smoked during pregnancy showed increased risk of spontaneous abortion, with a 27% increase occurring in dental assistants and a 21% increase in wives of dentists. A 34% increased risk of babies having congenital abnormalities was noted among smoking dental assistants.

3620 **(PB—88-869722/XAB) Toxicity of fibers and fiber composites. January 1970-September 1988 (Citations from the NTIS data base). Report for January 1970-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 276p. NTIS PC N01/MF N01.

Supersedes PB—87-864518.

This bibliography contains citations concerning the toxicity of occupational exposures to fibers and fiber composites. Topics include respiratory illnesses due to chronic exposure to asbestos and glass fibers, and methods and equipment for control of airborne fibers. (This updated bibliography contains 433 citations, 28 of which are new entries to the previous edition.)

5530 Agriculture And Food Technology

3621 **(CNIC—00135) Introduction to mutation breeding and genetic research of soybean in China.** Zhan Mingkui; Zhao Jingrong. (Shandong Academy of Agricultural Sciences, Jinan (China). Crops Research Inst.). (China Nuclear Information Centre, Beijing, BJ). Jan 1988. 18p. (In Chinese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704169/JAW.

This paper summarized the achievements and developments in mutation breeding and genetic research of soybean. The optimal irradiation dosage was determined for 22 varieties of soybean which have been released and popularized so far. Analyses of mutants, mutant characters and mutation frequency in the generations of M/sub 1/, M/sub 2/ and M/sub 3/ of soybean were carried out and a procedure of mutation breeding was described. Discussion of the effect of different radiant agents, the selection of progeny induced by radiation, the breeding method by combining mutation with hybridization and resistant varieties with good quality ones have been conducted.

3622 **(IC—88/273) On the possible effects of homeostatic shifts in human embryonic development.** Chela-Flores, J.; Espejo Acuna, C. (International Centre for Theoretical Physics, Trieste (Italy); Universidad Central de Venezuela, Caracas (Venezuela). Hospital Universitario de Caracas). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704765/JAW.

Possible etiological factors of congenital malformations, as well as of human trisomies are considered. We discuss the evidence that hyperthermia in particular may be an etiological factor for trisomies in humans. (author). 19 refs.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 3590

3623 **(AD-A—196901/3/XAB) Primary screening of potential radioprotective agents. Final report, 30 September 1986-15 March 1988; Annual report 30 September 1987-15 March 1988.** Sigdestad, C.P. (Louisville Univ., KY (USA). School of Medicine). 31 Mar 1988. 61p. NTIS, PC A04/MF A01.

This final report summarizes one and one-half year of research involving primary screening of potential radiation-protective agents. The compounds were tested in toxicity screens to determine the maximum tolerated dose (MTD) which was defined as the highest dose that produces no lethal effects. Limited available drug amounts precluded more refined testing. The second screen involved cobalt-60 gamma radiation. The agents to be tested were injected intraperitoneally into CD1 female Swiss mice, thirty minutes prior to irradiation with either 9.0 or 9.5 Gy. The latter value was found to be the radiation LD100(30) for this mouse strain. Survival was measured and the degree of protection was determined. Dose-modification factors were determined on a limited number of agents as directed by the COR.

3624 **(AERE-R—12833) Installation of a flow cytometry facility and some applications in radiobiology.** Walsh, M.; Kellington, J.P. (UKAEA Harwell Lab. Environmental and Medical Science Div.). Jan 1988. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755467/JAW.

Flow cytometry has enormous potential in many areas of experimental pathology. Details of the installation and commissioning of a flow cytometer at the Harwell Laboratory are described. Following an explanation of the principles of flow cytometry, several applications to specific problems in radiobiology are discussed. Also included are results of some preliminary studies with the Harwell flow cytometer on samples such as blood, bone marrow, macrophages and cell cultures, and a discussion of future applications.

3625 **(BNL—41836) Training requirements for chemists in radiotracer development for nuclear medicine.** Finn, R.; Fowler, J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 11p. (CONF-8802113—1). NTIS, PC A03/MF A01. Order Number DE89001611/JAW.

From Workshop on training requirements for chemists in nuclear medicine, nuclear industry and related areas; Washington, DC, USA (3 Feb 1988).

This panel was organized to address the current and anticipated future shortage of chemists with advanced training to fill positions in the nuclear medicine field. Although hard data and statistics are difficult to acquire, we will attempt to highlight the impact of chemistry on nuclear medicine and to describe the growth of the field which has led to an increasing need for chemists resulting in the current manpower shortage. We also will make recommendations for attracting Ph.D. chemists to careers in nuclear medicine research and possible mechanisms for postgraduate training. Solving this problem and establishing a long term committment and mechanism for advanced training is critically important to meet the current needs of the profession and to assure future growth and innovation. 3 tabs.

3626 **(CONF-8710285—1) Radiation protection guidelines for space missions.** Fry, R.J.M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006181/JAW.

From NATO advanced study institute on terrestrial space radiation and its biological effects; Corfu, Greece (12 Oct 1987).

The original recommendations for radiation protection guidelines were made by the National Academy of Sciences in 1970. Since that time the US crews have become more diverse in their makeup and much has been learned about both radiation-induced cancer and other late effects. While far from adequate there is now some understanding of the risks that high-Z and -energy (HZE) particles pose. For these reasons it was time to reconsider the radiation protection guidelines for space workers. This task was undertaken recently by National Council on Radiation Protection (NCRP). 42 refs., 2 figs., 9 tabs.

3627 **(DOE/OR/00033—T244) Radon protection and health effects.** (Committee on Interagency Radiation Research and Policy Coordination, Washington, DC (USA)). Aug 1986. Contract AC05-76OR00033. 19p. (CIRRPC—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87012860/JAW.

Exposure to radon has been a public health concern for the past thirty years. High indoor radon levels, which appear to be a result of entirely natural sources, have been found in some locations throughout the United States. This finding has received considerable public attention and raised questions about the extent and seriousness of the indoor radon problem in the United States. Among the scientific questions that must be addressed are those concerning: (1) the adequacy of existing health risk estimates; (2) the basis for standards and guidance for remedial actions; (3) the ability to identify specific areas that are likely to have unusually high radon levels; (4) the extent to which US population exposures are known; and (5) the availability of technology to mitigate or control elevated indoor radon levels. This report identifies and discusses several important issues related to these questions and recommends certain Federal actions that can assist in obtaining suitable answers.

3628 **(IC—87/355) Contribution of ultrasound forward scattering to tissue structure study.** Edee, M.K. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704690/JAW.

In this paper, we show how to get useful information of tissue structure by merely interpreting some experimental graphs such as energy spectral density and autocorrelation function of an ultrasonic beam travelling through tissues. To support these interpretations, we needed just some well-known theorems rather than heavy and complicated mathematical equations, so we measured the dimensions of scatterers within specimens by using the graphical representation of autocorrelation function. We related these measurements to the scattered peaks which appear in energy density spectrum. The values we found were equal to those obtained from biologists within ~ 15%. (author) 26 refs, 6 figs, tabs.

3629 **(IPEN-Pub—156) Effect of gamma irradiation on in vitro bovine lens proteins.** Bernardes, D.M.L.; Mastro, N.L. del. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 9p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704276/JAW.

The radiosensitivity of the ocular lens manifested by cataract formation has been of considerable interest in the study on the biological efects of radiations. Cataract can ben produced by different causes and also for the normal process of ageing. The aim of this work was to develop an in vitro system similar to in vivo cataract formation. It was used an aqueous solution of bovine lenses. The lenses after surgical removal mechanical and ultrasonic disrupted. The suspension was centrifuged and the supernatant was dialyzed and irradiated with different doses of /sup 60/Co radiation. The opacification extent was measured in an spectrophotometer.

3630 **(IPEN-Pub—170) Effects of imidazole derivatives in the survival of /sup 60/Co irradiated mice.** Villavicencio, A.L.C.H.; Mastro, N.L. del. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704280/JAW.

The presence of hypoxic and radioresistant cells is considered the main reason of failure in radiotherapy of neoplasms. Hypoxic cell radiosensitizers, as nitroimidazole derivatives, have an advantage over other alternative methods for improving the effects of radiotherapy since hypoxic cells exist in considerable concentration in tumours and only in small concentration in normal tissues. Its show also a direct cytotoxicity over the hypoxic cell population. In this work, studies on combining ip administered drugs and single dose radiation treatments in healthy albino mice are presented. It was compared the action of 2-nitroimidazole, levamisole and cysteine, the latest considered as radioprotector for several biological systems. The results showed some radioprotective action for 2 - nitroimidazole (MISO), sensitizer capacity for levamisole and in those conditions, cysteine failed to produce any effects on the survival of 9 Gy /sup 60/Co irradiated mice.

3631 **(JINR-R—19-88-47) Induction of bacteriophage λ and the radiosensitivity of lysogen Escherichia coli cells irradiated by γ-rays.** Bonev, M.N.; Kozubek, S.; Krasavin, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704881/JAW.

The radiosensitivity of the isogenic λ+, λ- E.coli strains and the prophage λ induction dependence on the exposure dose are considered on the basis of the conetmporary ideas about the function of SOS-system and about the biochemical mechanisms of prophage λ induction. The increased radiosensitivity of a lysogen strain is explained as a concequence of the interaction between the RecA-protein and the λ-repressor.

3632 **(JINR-R—19-88-49) λ prophage induction in lysogens E.coli by exposure to ionizing radiation of different LET.** Bonev, M.N.; Kozubek, S.; Krasavin, E.A.; Cherevatenko, A.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704882/JAW.

Submitted to the journal Radiobiologiya.

The dependence of λ prophage induction on the dose I(D) in lysogens of E.coli irradiated by ionizing radiation with different LET(L) has been investigated. The role of the balance of pleiotropic activities of RecA protein has been analysed. The expermental data were fitted by the function I(D)αD(1-exp(-D/sub 0//sup -1/ D))exp(-βD). The increase of induction potency α with increasing L was connected with increasing production of DNA lesions which are a signal for the SOS-system induction. 19 refs.; 2 figs.; 1 tab.

3633 **(JINR-R—19-88-81) Influence of the pre-irradiation cultivation conditions on the λ-prophage induction in Escherichia coli irradiated by γ-rays.** Bonev, M.N.; Kozubek, S.; Krasavin, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704883/JAW.

The dependence of λ-prophage induction I(D) on the dose in lysogen cells E,coli cultivated in different nutrient media and irradiated by γ-rays has been studied. the role of preparedness of the bacterial cells repair system has been shown for λ-prophage induction. 9 refs.; 2 figs.; 1 tab.

3634 **(KFK—4443) Investigations on the hepatotoxicity of cerium: In vivo experiments with rats and in vitro studies with hepatocytes and macrophages.** Wiener-Schmuck, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Genetik und Toxikologie von Spaltstoffen; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Bio- und Geowissenschaften). Aug 1988. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755589/JAW.

After intravenous injection of /sup 141/Ce with stable CeCl/sub 3/ Kupffer cells were found to be the main deposition site for Cerium in both female and male rats. After carrier-free electrophoresis at least 50% of the Cerium remained bound to enzymatic active lysosomes. These lysosomes showed no higher fragility as a possible sign of toxic damage. Lightmicroscopy, electronmicroscopy, and measurement of serum enzymes showed a higher sensitivity of female rats to Cerium compared to male rats. Injection of 1,3 mg/kg CeCl/sub 3/ to female rats resulted in an increase of fat deposition, in the swelling of Kupffer cells, in hepatocytenecrosis, and in the pathological elevation of serum enzyme concentration. No signs of damage were discovered in isolated rat hepatocytes after in vitro cultivation with Cerium. However rat and bovine alveolar macrophages, which were used as a model system for Kupffer cells, showed unequivocal toxic morphological and biochemical reactions to Cerium. In female rats the in vivo and in vitro results suggest that the observed liver damage is an indirect one, caused by the damage of the Kupffer cells. The lower susceptibility of the male rats to Cerium seems to be linked to sex-hormones.

3635 **(ORNL/NERP—2) Guidelines for field work and safety.** McConathy, R.K.; Parr, P.D. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 69p. NTIS, PC A04/MF A01. Order Number DE89001947/ JAW.

The purpose of this document is to provide new employees or guests information on the safety program in the Environmental Sciences Division at Oak Ridge National Laboratory and to acquaint the reader with procedural and operational information related to work at the Oak Ridge National Environmental Research Park (NERP). Topics discussed include general and radiation safety, medical concerns, and the quality assurance program. Procedures for conducting research, waste disposal, and radio use are reviewed. Requirements for field research and access to the NERP are also presented. Appendices have additional information, including safety signs, an off-hours field work checklist, and a map of the Oak Ridge Reservation. 16 refs.

3636 **(PB—88-247028/XAB) Current trends in survivorship of radiologists. Final report.** (National Inst. for Occupational Safety and Health, Rockville, MD (USA)). 1975. 30p. NTIS, PC A03/MF A01.

A study was made of the deaths of physicians who entered the Radiological Society of North America (RSNA), the American College of Physicians (ACP), the American Academy of Ophthalmology and Otolaryngology (AAOO), the American Roentgen Ray Society (ARRS), and the American Association of Pathologists and Bacteriologists (AAPB) societies from the 1900's through 1969. The findings indicated an excess risk of cancer and of all-cause mortality in radiologists. The early cohorts of radiologists showed a significant excess risk of leukemia, skin cancer, and aplastic anemia compared to the other groups of physicians. After 1940, all entrants into these cohorts demonstrated no excess risk of leukemia. An excess risk of multiple myeloma appeared in radiologists and a slight excess in otolaryngologists. In radiologists, the risk of all cause mortality appeared to begin about 8 to 9 years following entrance into the specialty and remained higher through the life span of those involved in this field; the high risk of all cancers appears to occur 10 to 12 years after entering the specialty.

3637 **(AERE-R—12045(v.A-and-v.E(DRAFT-A))) Epidemiological surveys on the effects of low-level radiation dose: a comparative assessment. Vol. A: pre-conception irradiation effects. Vol. E (DRAFT A): group collation tables.** Rose, K.S.B. (UKAEA Harwell Lab. Environmental and Medical Science Div.). Jan 1988. 232p. H.M. Stationery Office, London, price Pound 12.00.

In this report, the health effects of low-level doses of radiation are considered by reference to published epidemiological surveys. The work was carried out with three objectives in mind: 1. to provide a comprehensive and critical review of the subject; 2. to seek consistent indications of particular health effects by collating results and comparing with those from surveys at moderate-level doses; 3. to provide an authoritative view on the epidemiology of low-level radiation-induced health effects. Vol E (DRAFT A) is appended and contains group collation tables. Epidemiological surveys can be conveniently divided into four classes (A, B, C, D) according to the phase of life when irradiation occurs or the effect is diagnosed. The first of the classes (A) is addressed here; this class is concerned with possible effects arising from radiation received by a parent before conception. Possible effects of preconception irradiation were identified under four broad groupings. These are Down's syndrome, "Indicators of Reproductive Damage" (mainly Primary Sterility, Congenital Abnormalities, Sex Ratio, Fetal Mortality, Infant Mortality), Childhood Malignancies, and Chromosomal Changes in Abortuses. Information about each survey, and comparisons with results from moderate-level dose surveys, are contained in synopses that are set out in the Appendix.

3638 **Historical estimates of external gamma exposure and collective external gamma exposure from testing at the Nevada Test Site. I. Test series through HARDTACK II, 1958.** Anspaugh, L.R.; Church, B.W. (Lawrence Livermore National Lab., CA (USA)). *Health Physics;* **51**: No. 1, 35-51(Jul 1986).

In 1959, the Test Manager's Committee to Establish Fallout Doses calculated estimated external gamma exposure at populated locations based upon measurements of external gamma-exposure rate. Using these calculations and estimates of population, we have tabulated the collective estimated external gamma exposures for communities within established fallout patterns. The total collective estimated external gamma exposure is 85,000 person-R. The greatest collective exposures occurred in three general areas: Saint George, UT; Ely, NV; and Las Vegas, NV. Three events, HARRY (19 May 1953), BEE (22 March 1955), and SMOKY (31 August 1957), accounted for more than half the total collective estimated external gamma exposure. The bases of the calculational models for external gamma exposure of infinite exposure, estimated exposure, and 1-yr effective biological exposure are explained.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 2782, 3133, 3512, 3518, 3571, 3618

3639 (AD-A—196846/0/XAB) Assessing ecosystem impacts from simulant and decontaminant use. Contractor report, March-September 1985. Kerster, H.W.; Schaeffer, D.J.; Reinbold, K.A. (Army Construction Engineering Research Lab., Champaign, IL (USA)). May 1988. 64p. NTIS, PC A04/MF A01.

Chemicals for simulation and decontamination of chemical warfare agents may alter the ecosystems of training sites and their environs. Little information is available on the ecotoxicology of those chemicals. This report presents methods from the literature and proposes a newly devised approach to rank those chemicals for damage potential. Further data necessary to reduce ranking errors are identified, and chemical and ecological monitoring of training sites and their surroundings are recommended. The information in this report should be of special interest to U.S. Army personnel responsible for environmental protection of training areas.

3640 (PB—88-234372/XAB) Effect of nitrogen dioxide, ozone, and peroxyacetyl nitrate on metabolic and pulmonary function. Research report, September 1983-October 1986. Drechsler-Parks, D.M. (Health Effects Inst., Cambridge, MA (USA)). Apr 1987. 43p. (HEI/RR—87/06). NTIS, PC A03/MF A01.

See also PB—88-234364.

The report is the first published account of the pulmonary and metabolic effects of oxidant air pollutants on healthy men and women, middle-aged and older, compared with young adults of either gender. Dr. Drechsler-Parks exposed each of 32 subjects to 0.13 ppm peroxyacetyl nitrate, 0.45 ppm ozone, 0.6 ppm nitrogen dioxide and air, plus a combination of two, and then all three, of the oxidant gases. Their responses to the exposures were measured after alternating periods of exercise and rest over a two-hour period. The results of the study were: (1) mixtures of gases did not cause an enhanced effect; (2) pulmonary effects were observed for ozone but not for the other gases; (3) women showed a slightly larger percentage decrement of lung function in response to ozone than did men; and (4) older people (51 to 76 years) may be less responsive to ozone than are younger people (18 to 26 years). The author discusses the significance, limitations, and interpretations of these findings in detail.

3641 (PB—88-234398/XAB) Effects of inhaled nitrogen dioxide and diesel exhaust on developing lung. Research report, January 1984-October 1986. Mauderly, J.L.; Bice, D.E.; Carpenter, R.L.; Gillett, N.A.; Henderson, R.F. (Health Effects Inst., Cambridge, MA (USA)). May 1987. 49p. (HEI/RR—87/08). NTIS, PC A03/MF A01.

See also PB—88-234380.

This study examined the physiological response of both developing and mature rats to inhaled automotive emissions. A total of 384 rats in two age groups (from conception to 6 months and from 6 months to 12 months) were exposed to either 9.5 ppm nitrogen dioxide (NO_2) or 3.5 mg/cu m of diesel exhaust soot for 7 hours/day, 5 days/week over a six-month period. Body weight, respiratory function, pulmonary immune response, lung clearance of radiolabeled particles, airway fluid enzymes, lung tissue collagen, proteinase, lung burden of diesel soot, lung morphometry, and histopathology were measured. The study concluded that normal lung development was not affected by NO_2 or diesel exhaust soot. In adults, clearance of soot from the lungs was slower, with the persistence of aggregated macrophages in the alveoli and evidence of septal thickening. Adults exposed to soot or NO_2 showed a sixfold increase in the percentage of neutrophils in the airways fluid.

3642 (PB—88-234414/XAB) Predictive models for deposition of inhaled diesel exhaust particles in humans and laboratory species. Research report, July 1984-January 1987. Yu, C.P.; Xu, G.B. (Health Effects Inst., Cambridge, MA (USA)). Jul 1987. 33p. (HEI/RR—87/19). NTIS, PC A03/MF A01.

See also PB—88-234406.

A deposition model for diesel-exhaust particles was formulated mathematically from available scientific data, and was used to predict the deposition of particles in the airways of laboratory animals and of humans of different ages. In addition, a lung-growth model was formulated for humans, from infancy to adulthood, to predict the effect of age on deposition. The investigators predicted from their models that: (1) deposition in the alveoli is markedly affected by changes in the size distribution of particles; (2) nose- versus mouth-breathing had little effect on deposition in the alveoli; (3) increased minute ventilation substantially increased the rate of particle deposition; and (4) age (in humans) influenced the levels of deposition observed in the unciliated regions of the airways (the highest levels of deposition occurred in infants under two years, decreased in children over two years, and decreased again in adults aged 25 years or older); and (5) the deposition rate in laboratory animals was higher than in humans of all ages.

3643 (PB—88-234422/XAB) Effects of ozone and nitrogen dioxide on human lung proteinase inhibitors. Research report, May 1983-January 1987. Johnson, D.A. (Health Effects Inst., Cambridge, MA (USA)). Aug 1987. 34p. (HEI/RR—87/11). NTIS, PC A03/MF A01.

See also PB—88-234414.

This study investigated the usefulness of the oxidized forms of alpha-1-proteinase inhibitor (PI) and bronchial leukocyte proteinase inhibitor (BLPI) as in vivo markers for ozone (O_3) and nitrogen dioxide (NO_2) exposure. It was concluded that the existing assays were not sufficiently sensitive as markers of O_3 exposure. In vitro studies on the exposure of proteinase inhibitors to O_3 showed that despite their differing amino-acid compositions, they displayed similar kinetics of deactivation. While the amino acids (tryptophan, methionine, tyrosine, and histidine) were found to be most susceptible to oxidation, the absence of these did not affect the deactivation kinetics, nor did the presence of stabilizing disulfide bridges in BLPI provide increased protection against O_3. Free-radical scavengers offered more protection against oxidants than against antioxidants. The studies on NO_2 were incomplete. However, it appears that the mechanisms of action of O_3 and NO_2 are similar.

3644 (PB—88-234430/XAB) Neurotoxicity of prenatal carbon monoxide exposure. Research report, April 1983-October 1986. Fechter, L.D. (Health Effects Inst., Cambridge, MA (USA)). Sep 1987. 37p. (HEI/RR—87/12). NTIS, PC A03/MF A01.

See also PB—88-234422.

This study investigates the effects of carbon monoxide (CO) on the nervous system. Rats were exposed to 75, 150, and 300 ppm CO throughout gestation, and in some cases up to 10 days after birth. At these doses, the mothers were unaffected by CO as determined by their body weight. Significant changes were observed in the cerebellum and the neostriatum of the neonates, but no persistent effects were observed in the hippocampus or pons medulla. The cerebellum showed a decrease in weight and a reduction in neurochemical markers of gamma amino butyric acid-ergic neurons. In addition, a slight elevation in norepinephrine concentration was observed. Decreased numbers of fissures, and degenerating Purkinje and granule cells, suggested reduced cerebellar cortex growth. In the neostriatum, an increase in dopamine content was detected at 150 ppm and at 300 ppm, and an increase in DNA content was measured at 300 ppm CO only, indicating increased cell numbers (possibly of glial cells) in response to neuronal injury.

3645 (PB—88-234448/XAB) Effects of nitrogen dioxide on alveolar epithelial barrier properties. Research report, September 1983-January 1987. Crandall, E.D.; Cheek, J.M.; Shaw, M.E.; Postlethwait, E.M. (Health Effects Inst., Cambridge, MA (USA)). Oct 1987. 32p. (HEI/RR—87/13). NTIS, PC A03/MF A01.

See also PB—88-234430.

This study used primary cultures of rat Type II pneumocytes to investigate if, and how, nitrogen dioxide (NO_2) alters the permeability of the alveolar epithelia. Susceptibility of cells to NO_2 appears to depend on the nutrient media of the cells, with a 10-fold difference observed between minimum essential medium (MEM) and MEM supplemented with Ham's F12 media. No protective effect was observed when the antioxidant, vitamin E, was added to

the media. Bioelectric studies were conducted on cells cultured on a porous substrate. Exposure to 20 ppm NO_2 caused significant reductions in tissue resistance but not in short-circuit current. It was concluded that NO_2 primarily affects epithelial active and passive transport via altered tight junctional pathways that result from damage to paracellular tight junctions or, possibly, to transcellular transport membrane pumps. The authors suggest that free-radical formation causes the damage observed.

3646 **(PB—88-234455/XAB) Effects of ozone and nitrogen dioxide on lung function in healthy and asthmatic adolescents. Research report, April 1983-April 1987.** Koenig, J.Q.; Pierson, W.E.; Marshall, S.G.; Covert, D.S.; Morgan, M.S. (Health Effects Inst., Cambridge, MA (USA)). Jan 1988. 34p. (HEI/RR—87/14). NTIS, PC A03/MF A01.

See also PB—88-234448.

This project investigated whether or not well-characterized groups of healthy adolescents and adolescents with asthma differed in their sensitivity to ozone and nitrogen dioxide (NO_2). During Phase I, pulmonary function was not consistently altered in either the asthmatic or the healthy adolescents with these exposures. In Phase II, small but significant increases in total respiratory resistance to all test atmospheres were seen, after exposure at 0.12 ppm during 10 minutes of exercise, in both healthy and asthmatic adolescents, but were not statistically different between the groups. In Phase III, statistically significant changes were seen in average total respiratory resistance values in both healthy and asthmatic adolescents exposed to 0.18 ppm ozone while exercising. Again, the difference between the groups was not significant.

3647 **(PB—88-234463/XAB) Susceptibility to virus infection with exposure to nitrogen dioxide. Research report, January 1984-July 1987.** Kulle, T.J.; Clements, M.L. (Health Effects Inst., Cambridge, MA (USA)). Jan 1988. 30p. (HEI/RR—88/15). NTIS, PC A03/MF A01.

See also PB—88-234455.

The interaction between nitrogen dioxide (NO_2) exposure and human susceptibility to respiratory virus infection was investigated in a placebo-controlled, randomized, blinded trial conducted in an environmentally controlled research chamber. Healthy, nonsmoking volunteers, 18 to 35 years old, who were seronegative to influenza A/Korea/82 (H_3N_2) virus, breathed either filtered air or NO_2 for two hours a day for three consecutive days. Live, attenuated cold-adapted influenza A/Korea/82 reassortant virus was administered intranasally to all subjects after the second day of exposure. No adverse changes in pulmonary function or nonspecific airway reaction to methacholine were observed after NO_2 exposure, virus infection, or both. Although the differences were not statistically significant, the groups exposed to NO_2 in year 3 became infected more often (91%) than those exposed only to air (71%).

3648 **(PB—88-234471/XAB) Metabolism and biological effects of nitropyrene and related compounds. Research report, August 1983-July 1987.** King, C.M. (Health Effects Inst., Cambridge, MA (USA)). Feb 1988. 38p. (HEI/RR—88/16). NTIS, PC A03/MF A01.

See also PB—88-234463.

The specific aims of the study were to: (1) compare relative tumorigenicities of 1,3-, 1,6-, and 1,8-dinitropyrene, 1-nitropyrene, and the metabolic phenolic derivatives of 1-nitropyrene; (2) contrast different routes of administration; (3) explore the influence of age; (4) compare strain differences in susceptibility; and (5) investigate the metabolic capacity of the rat mammary gland. The most likely tumors to be induced were malignant fibrous histiocytomas (MFHs), mammary gland tumors, and leukemias. Neonatal animals were more susceptible to MFH induction than were weanling rats. Rats of the Fisher strain were less susceptible to tumor induction than were CD animals. Mammary cytosolic enzymes activated the dinitropyrenes by monoreduction to hydroxylamine, and subsequent O-acetylation. Reduction of 1-nitropyrene was more limited, and hydroxylamine could not be activated by O-acetylation. Intact cells metabolized 1-nitropyrene primarily via oxidative pathways. Nucleic acid adduct formation paralleled the carcinogenic potential of the compounds in the intact animal.

3649 **(PB—88-234489/XAB) Studies on the metabolism and biological effects of nitropyrene and related nitro-polycyclic aromatic compounds in diploid human fibroblasts. Research report, July 1983-July 1987.** Maher, V.M.; Patton, J.D.; McCormick, J.J. (Health Effects Inst., Cambridge, MA (USA)). Mar 1988. 46p. (HEI/RR—88/17). NTIS, PC A03/MF A01.

See also PB—88-234471.

The cytotoxic effects of 1-nitropyrene (1-NP) and 1-nitrosopyrene (1-NOP) were compared in fibroblasts from normal persons, from excision-repair-deficient xeroderma pigmentosum (XP) patients, and from a patient with a predisposition to hereditary cutaneous malignant melanoma (HCMM). On the basis of concentration, 1-NOP was much more cytotoxic than 1-NP. When exposed to the same concentration of an agent, the normal and XP cells formed approximately the same number of initial DNA adducts, but the survival rate of the XP cells was much lower than that of the normal cells. On the basis of concentration, 1-NOP was much more mutagenic than 1-NP, and the XP cells were much more sensitive than normal cells to the induction of mutations by either compound, although the two compounds had virtually the same cell killing and number of initial adducts in a particular cell type.

3650 **(PB—88-235718/XAB) Respiratory effects of acid containing-multicomponent pollutant atmospheres. Final report, 29 April 1985-29 July 1987.** Mautz, W.J.; Kleinman, M.T.; Finlayson-Pitts, B. (California Univ., Irvine (USA). Dept. of Community and Environmental Medicine). May 1988. 97p. NTIS, PC A05/MF A01.

The purpose of the study was to assess adverse effects on the respiratory system caused by inhaling acidic air pollutants in mixtures with other pollutants commonly present in California urban air. The investigators exposed rats for four hours to either: a mixture of ozone, nitrogen dioxide, sulfur dioxide, manganese, ferric and ammonium sulfates, and carbon soot; a mixture of nitric acid and sulfuric acid; a mixture of ozone and nitrogen dioxide; or ozone. The effects examined included: reflex breathing-pattern changes, histopathological changes in the lung and nasal regions, changes in particle-clearance rates, and changes in pulmonary surfactant. Acid components had no significant effects on the parameters examined. Mixtures containing 0.35-ppm ozone showed effects that could be attributed to ozone alone.

3651 **(PB—88-239835/XAB) Environmental issues: noise, rail noise, and high-speed rail.** Hall, F.L.; Welland, J.D.; Bragdon, C.R.; Houtman, J.W.; Immers, B.H. (National Research Council, Washington, DC (USA). Transportation Research Board). 1987. 52p. (TRB/TRR—1143). NTIS, PC A04/MF A01.

Library of Congress catalog card no. 88-16053.

The six papers in the report deal with the following areas: the effect of noise barriers on the market value of adjacent residential properties; control of airport- and aircraft-related noise in the United States; a traffic-assignment model to reduce noise annoyance in urban networks; a survey of railroad occupational noise sources; a prediction procedure for rail transportation ground-borne noise and vibration; and high-speed rail in California: the dream, the process, and the reality.

3652 **(PB—88-240155/XAB) Silica-dust inhalation and resistance to infections. Progress report.** Zarkower, A.; Ferguson, F.G. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1978. 126p. NTIS, PC A07/MF A01.

To determine the effects of silica-dust inhalation on the immunological defense mechanisms which are involved in pulmonary resistance to infection, mice were housed in exposure chambers and subjected to various concentrations of silica dust for various lengths of time; control mice were similarly housed without exposure to silica dust. These exposures were followed by examination of a variety of immunologic responses and morphological studies of tissue. There was a very severe reduction in the numbers of antibody-forming cells in spleens and mediastinal lymph nodes after aerosol administration of antigens. There was decreased phagocytic activity of lung macrophages and decreased lung clearance of inhaled bac-

teria. There was a decrease in the antigen processing ability of lung-derived macrophages, and a decreased response to antigens of spleen cells from silica-exposed animals used to repopulate gamma-irradiated syngenetic recipients. There were progressive cellular changes into the lungs including early infiltration of chronic inflammatory cells, followed by the development of silica containing macrophages and, after 39 weeks of exposure, the presence of silica-associated fibrotic nodules both in the lungs and in the mediastinal lymph nodes. It is concluded that mice exposed in the manner serve as excellent models for further study of pathogenesis of diseases caused by inhalation of other toxic substances besides silica.

3653 **(PB—88-240197/XAB) Influence of exposure history on mercury excretion. Final report.** Cember, H. (Northwestern Univ., Evanston, IL (USA). Technological Inst.). Oct 1973. 56p. NTIS, PC A04/MF A01.

Determination of whether the size of a dose of a given mercurial influences the kinetics of distribution and elimination of the mercury was the objective of the research. Great differences in urinary mercury output were observed among workers of the same group. Results of the study are considered applicable to strengthening the scientific basis for the bioassay monitoring portion of the occupational-health surveillance program designed to prevent damage to exposed workers. The dose dependence of elimination kinetics is studied by injecting labeled mercury at various dose levels into rabbits and rats, measuring the elimination from the animal directly by total-body-counting techniques and indirectly by analysis of the daily urine and feces output of each animal.

3654 **(PB—88-240437/XAB) Twenty-one-day exposure to mixed air pollutants: effects on lung airways and macrophages. Final report, 11 February-11 November 1987.** Phalen, R.F.; Kleinman, M.T. (California Univ., Irvine (USA). Dept. of Community and Environmental Medicine). 31 Jul 1987. 10p. NTIS, PC A02/MF A01.

The investigators exposed rats to a 7-component mixture (consisting of ozone, nitrogen dioxide, sulfur dioxide, ammonium sulfate, ferric sulfate, manganese sulfate, and ferric oxide). The exposures lasted for 4 hours per day for either 7 or 21 days. They observed significant effects on pulmonary macrophage function, with more pronounced effects seen after 21 days of exposure. These effects persisted up to 96 hours post-exposure. No statistically significant effects on nasal or bronchoalveolar epithelial permeability were detected.

3655 **(PB—88-242359/XAB) Health and Environmental Effects Profile for isophorone.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Mar 1986. 84p. (EPA—600/X-86/084). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for isophorone was prepared support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life, and environmental effects. Quantitative estimates are presented provided sufficient data are available. Isophorone has been evaluated as a carcinogen. The human carcinogen potency factor (q1*) for isophorone is .0041/(mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value for isophorone is 1000.

3656 **(PB—88-242367/XAB) Health and Environmental Effects Profile for methyl bromide.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 95p. (EPA—600/X-86/171). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for methyl bromide was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects. Quantitative estimates are presented provided sufficient data are available. Methyl bromide has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), for methyl bromide is 0.0014 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for methyl bromide is 100.

3657 **(PB—88-242375/XAB) Health and Environmental Effects Profile for ethyl methacrylate.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 47p. (EPA—600/X-86/212). NTIS, PC A03/MF A01.

The Health and Environmental Effects Profile for ethyl methacrylate was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects. Quantitative estimates are presented provided sufficient data are available. Ethyl methacrylate has been determined to be a systemic toxicant. An acceptable daily intake (ADI) for ethyl methacrylate is 0.086 mg/kg/day for oral exposure.

3658 **(PB—88-242383/XAB) Health and Environmental Effects Profile for naphthalene.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Aug 1986. 133p. (EPA—600/X-86/241). NTIS, PC A07/MF A01.

The Health and Environmental Effects Profile for naphthalene was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic life, and environmental effects. Naphthalene has been determined to be a systemic toxicant. The daily exposure to the human population that is likely to be without appreciable risk of the deleterious effect during a lifetime for naphthalene is 0.40 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for naphthalene is 1000.

3659 **(PB—88-243845/XAB) Health and Environmental Effects Profile for methyl chloride.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 110p. NTIS, PC A06/MF A01.

The Health and Environmental Effects Profile for methyl chloride was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response. Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life, and environmental effects of hazardous-waste constituents. Quantitative estimates are presented, provided sufficient data are available. Methyl chloride has been evaluated as a carcinogen. The human carcinogen potency factor (q1*) for methyl chloride is .0126/(mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value for methyl chloride is 1000.

3660 **(PB—88-243852/XAB) Health and Environmental Effects Profile for malononitrile.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Sep 1986. 51p. (EPA—600/X-86/258). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for Malononitrile was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous waste constituents. Quantitative estimates are presented, provided sufficient data are available. That is likely to be without appreciable risk of deleterious effect during a lifetime, for malononitrile is 0.02 microgram/kg/day for oral exposure. The Reportable Quantity (RQ) value for malononitrile is 100.

3661 **(PB—88-247614/XAB) Aerosol deposition in the human respiratory system. Final report.** Yu, C.P. (State Univ. of New York, Buffalo (USA)). 1988. 16p. NTIS, PC A03/MF A01.

Attempts were made to develop mathematical models for the deposition of aerosols in the human respiratory system. Expressions were obtained for the mean deposition efficiency for nasal inspiration, nasal expiration, and mouth inspiration. A determination was made of statistical properties associated with each deposition efficiency due to intersubject and intrasubject variabilities. Expressions were then derived for head deposition with combined nose and mouth breathing. In the lung, deposition is a result primarily of impaction, sedimentation, and diffusion. While there was no adequate model for impaction, several deposition formulae for sedimentation were derived as well as ones for diffusion. Studies were also made of the particle charge effect, as the electrostatic image force on a particle contributes to its deposition. There is, however, a threshold charge per particle below which the particle charge has no effect on deposition. Deposition data on ultrafine particles is scarce due to the difficulties in conducting proper experiments.

3662 **(PB—88-247648/XAB) Methyl methacrylate-induced changes in CNS (central nervous system) activity. 1 March 1978-28 February 1980.** Innes, D.L. (Temple Univ., Philadelphia, PA (USA)). 1980. 12p. NTIS, PC A03/MF A01.

Experiments were performed to determine if methyl-methacrylate (MMA) monomer vapor in air caused central nervous system (CNS) changes in exposed rats. Rats were exposed to 400 parts per million (ppm) MMA vapor for 60 minutes. The only significant changes occurred in the lateral hypothalamic and ventral hippocampal nuclei. Several substudies suggested that the changes in the hippocampal neuronal firing rates were related to the perception of the MMA odor and dependent on an intact nervous connection to the receptors in the nose. In a subchronic study no consistent long term changes in neuronal activity were detected. However, a decrease in neuronal activity was detected during the first week of exposure. In another study, the exposure levels of MMA ranged from 50 to 800 ppm. The lateral hypothalamic and ventral hippocampal nuclei responded as before, but not at the 50 ppm level. The author concludes that the threshold exposure concentration for the observed effects are the same as or slightly less than the current threshold limit value for MMA vapor in the workplace.

3663 **(PB—88-247697/XAB) Exposure to mixtures of airborne contaminants. Final report, 1 May 1974-30 April 1977.** Smith, F.A. (Rochester Univ., NY (USA). School of Medicine and Dentistry). 1977. 27p. NTIS, PC A03/MF A01.

Attempts were made to characterize the response of laboratory animals to particulates carried in the air and to gaseous airborne pollutants, as a preliminary step towards investigation of the effects of a mixture of gaseous and particulate pollutants. Guinea pigs were exposed to fluoride at 1.2mg/m^3 as fluorspar dust of respirable size for 16 weeks, or to fluoride at 3.3mg/m^3 as hydrogen-fluoride. The fluoride concentrations were increased in plasma, femur, and feces. Hydrogen-fluoride exposure also increased fluoride levels in the bile and urine. The number of alveolar macrophages was increased on dust exposure, whereas the incidence of patchy pneumonitis was decreased on hydrogen-fluoride exposure. All these changes returned to normal after exposure to the fluoride agents was terminated, with the exception of skeletal fluoride levels. No evidence of continuing harmful effects was noted.

3664 **(PB—88-248042/XAB) Industrial-dust interaction with respiratory mucosa. Final report.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 1980. 6p. NTIS, PC A02/MF A01.

The interaction of selected organic and inorganic particulates with the respiratory epithelium was investigated. The findings indicated that different types of dust generated different biological responses. The effects of various foreign materials adhering to dust particles were also explored. An analysis of the uptake of polycyclic hydrocarbons on various types of asbestos fibers and their release in conjunction with the proliferative effect on the respiratory epithelium was one such research project. Studies demonstrated the importance of the zeta potential in determining cytotoxicity. The role of naturally occurring substances in altering the interaction of these particulates with the epithelial cells was discovered.

3665 **(PB—88-869904/XAB) Ethylene dibromide: biochemical effects and environmental concerns. January 1978-September 1988 (Citations from the Life Sciences Collection data base). Report for January 1978-September 1988.** (National Technical Information Service, Springfield, VA (USA)). Oct 1988. 96p. NTIS PC N01/MF N01.

Supersedes PB—86-866324.

This bibliography contains citations concerning the toxicity and environmental issues pertaining to the fumigant ethylene dibromide. Topics include effects on liver activity, respiratory systems and DNA synthesis in laboratory animals, comparisons and synergistic effects with other pesticides, and occupational-health considerations. The distribution of the compound in the environment and its effectiveness as a fumigant are also considered. (This updated bibliography contains 193 citations, 51 of which are new entries to the previous edition.)

3666 **Nitrogen stress effects on growth and seed yield of nonnodulated soybean exposed to elevated carbon dioxide.** Cure, J.D.; Israel, D.W.; Rufty, T.W. Jr. (Duke Univ., Durham, NC (USA)). *Crop Science;* **28**: No. 4, 671-677(Jul-Aug 1988). Contract FG05-85ER60373.

Limitations in nutrient availability apparently can restrict plant response to CO_2 enrichment; however, the alterations in physiological processes associated with such restrictions have not been defined. This experiment was conducted to investigate certain physiological responses of N-limited soybean [Glycine max (L.) Merr. cv. Lee] plants growing in a CO_2 enriched environment and to examine their role in determining growth and yield. The nonnodulating soybean plants were grown to maturity in controlled environment chambers at 350 or 700 $\mu L\ L^{-1}$ CO_2 and at 0.05, 1.0, 2.5, 5.0, or 10.0 mM KNO_3^- supplied in nutrient solution. Substantial increases in whole-plant growth and seed yield occurred in both CO_2 treatments with increasing nitrate levels; the increases were greater, however, at high CO_2. At all NO_3^- levels except the lowest, exposure to high CO_2 resulted in increased total leaf area, mean net assimilation rate, NO_3^- uptake, and N utilization efficiency. Increased NO_3^- uptake was associated with larger root systems, as uptake per unit of root mass was lower than controls. Carbon dioxide enrichment had little effect on dry matter partitioning among plant parts or harvest index. Alterations in partitioning were related to differences in NO_3^- supply. The results suggest that atmospheric CO_2 enrichment can stimulate seed yield of soybean even when the availability of N in the rhizosphere is limited.

3667 **Determination of a volatile gas, vinylidene fluoride, in blood during a nose-only exposure.** Bechtold, W.E.; Medinsky, M.A.; Gerlach, R.F. (Inhalation Toxicology Research Institute, Albuquerque, NM (USA)). *Journal of Analytical Toxicology;* **12**: No. 2, 62-66(Mar-Apr 1988). Contract AC04-76EV01013.

A method has been developed for measuring the volatile gas vinylidene fluoride (VDF) in the blood of rats during nose-only exposure. Blood was sampled via a jugular cannula was constructed from silastic tubing. The silastic cannula was sutured and glued to the vein and was passed subcutaneously to the back of the rat's

neck, where it was externalized and anchored in the same manner. Securing the cannula at these two sites stabilized its position in the vein. A strip of Velcro sutured to the skin of the animal's back served to protect and store the external part of the cannula. VDF in blood was measured by headspace sampling and gas chromatography. The gas chromatograph was equipped with a packed column and a flame ionization detector. The method requires 250 μL of blood and has a detection limit of 6 ng/mL of VDF in blood (S/N: 3 x 1). Vinylidene fluoride in the blood reached equilibrium with the headspace within 1.5 h and was stable for up to 4.0 h. The relative standard deviation for blood levels determined under experimental conditions was less than 15%. The interday reproducibility of the standard curve was +/- 3.5%.

3668 **Determination of biurea in the presence of azodicarbonamide by HPLC.** Bechtold, W.E.; Shopp, G.M.; Cheng, Y.S. (Inhalation Toxicology Research Institute, Albuquerque, NM (USA)). *Journal of Analytical Toxicology;* **12**: No. 2, 89-93(Mar-Apr 1988).

Azodicarbonamide (ADA), a solid blowing agent used in the manufacture of plastics, has been selected for inhalation toxicity testing by the National Toxicology Program. To test for decomposition of ADA during aerosolization, an HPLC method was developed to quantitate the relative amounts of one possible degradation product, biurea, in bulk samples and filter samples collected after aerosolization. The method uses a C_{18} column with 10-μm particles, UV monitoring at 190 nm for biurea and 425 nm for ADA, and a mobile phase of 100% water. Quantitation is with ^{14}C-labeled biurea and ADA as external standards. The assay was validated by spiking bulk ADA with projected levels of 1, 2, and 3% biurea. Levels of biurea bound in both bulk and filter-collected aerosol samples ADA were both 0.50%, with relative standard deviations of 13 and 26%, respectively.

3669 **Comparative in vitro cytotoxicity of nickel oxides and nickel-copper oxides to rat, mouse, and dog pulmonary alveolar macrophages.** Benson, J.M.; Henderson, R.F.; Pickrell, J.A. (Inhalation Toxicology Research Institute, Albuquerque, NM (USA)). *Journal of Toxicology and Environmental Health;* **24**: No. 3, 373-383(1988). Contract AC04-76EV01013.

Metal oxides containing either Ni alone (NiO's) or both Ni and Cu (Ni-CuO's) are encountered during Ni refining. Six NiO compounds calcined at temperatures ranging from < 650 to 1045° and four Ni-CuO's containing from 6.9 to 28% Cu and 44 to 69% Ni were screened for their in vitro cytotoxicity to alveolar macrophages (AM). NiO's were less toxic to rat AM than were the Ni-CuO compounds. The toxicity of the Ni-CuO compounds increased with increasing Cu content and decreasing Ni content of the molecules, indicating that the toxicity was due to the Cu content of the molecules. AM obtained from beagle dogs, F344/N rats, and $B6C3F_1$ mice displayed the following species sensitivities: dog > rat ≈ mouse, with dog AM being most sensitive. The observed differences in species sensitivities correlated with differences in the phagocytic abilities of dog, rat, and mouse AM, with the ranking of phagocytic abilities of the AM in decreasing order of ability being dog > rat > mouse.

3670 **Female reproduction and pup survival and growth for mice fed a cadmium-containing purified diet through six consecutive rounds of gestation and lactation.** Whelton, B.D.; Bhattacharyya, M.H.; Carnes, B.A.; Moretti, E.S.; Peterson, D.P. (Eastern Washington Univ., Cheney (USA)). *Journal of Toxicology and Environmental Health;* **24**: No. 3, 321-343(1988). Contract W-31-109-ENG-38.

Female CF1 mice were bred for 6 consecutive, 42-d rounds of gestation-lactation. Their purified diets contained cadmium added at either 0.25, 5.0, or 50.0 ppm Cd; at each cadmium level, the diets were either sufficient or deficient in certain vitamins, minerals, and fat. The deficient diet at 5 ppm cadmium was designed to simulate conditions implicated in the etiology of itai-itai disease among multiparous women in Japan. Fertility, litter size, pup survival, and pup growth (weaning weight) are reported for mice on the six diets during each of the six rounds of gestation/lactation. Except for fertility, decreases in reproductive measures that occurred in response to dietary deficiencies of cadmium during round 1 or reproduction were repeated, unchanged in magnitude, in each successive round. For sufficient diet groups, 50 ppm cadmium had no effect on fertility or pup survival during lactation, but caused a 15% decrease in litter size at birth and a 25% decrease in pup growth. Dietary deficiencies alone decreased all four measures of reproductive performance; fertility by 12%, litter size by 30%, pup survival by 18%, and pup growth by 42%. In addition, dietary deficiencies strikingly decreased the incidence of consecutive pregnancies. Combined effects of 50 ppm cadmium and dietary deficiencies were additive for all reproductive measures except fertility; for fertility, cadmium caused no decrease in the fertility of sufficient-diet animals, but caused a striking 45% decrease in deficient-diet animals. Relating the authors results to humans, women who contracted the itai-itai disease (analogous to mice on the deficient, 5 ppm cadmium diet), in addition to their characteristic bone disease, could have experienced decreases in fertility and in growth of their offspring related to their dietary deficiencies.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 3480

3671 **(AD-A—196486/5/XAB) Treatment of laser-induced retinal injuries. Final report, 1 November 1983-31 October 1984.** Belkin, M.; Naveh, N. (Tel Aviv Univ. (Israel)). Jan 1985. 29p. NTIS, PC A03/MF A01.

Prostanoids are mediators of the inflammatory process in many organs, including the eye, and their production from arachidonic acid is triggered by a variety of stimuli including laser burns. The authors have suggested that prostanoids might be involved in laser induced retinal burns and that it is likely that anti-inflammatory drugs that inhibit arachidonic acid metabolism can help accelerate retinal healing. In addition, they have suggested that an increase in prostanoid levels in the retina/choroid or vitreous cavity might cause a break in the blood retinal barriers and protein leakage into the vitreous. Their preliminary study indicates that both a single retinal laser burn and 10 laser burns cause an increase in PGE2 and prostacyclin levels of the choroid at 18 hours after lasing. However, results were inconsistent and required the use of 3 samples of each tissue for a single determination. Modifications done in order to overcome these problems involved the use of a tissue preparation of unseparated retina/choroid, and exposed the retina to 30 laser burns. Thus, a single tissue sample was adequate for measurement. Indeed, PGE2 levels in retina/choroid and vitreous of eyes subjected to 30 moderate laser applications demonstrated an increase in prostaglandin E2 (PGE2) and prostacyclin levels throughout a 3-day period after lasing. This mode of lasing was chosen as the working model and confirmed the hypothesis of PGE2 and prostacyclin involvement in laser induced retinal damage.

3672 **(PB—88-240312/XAB) Coordinated textile industry noise reduction program. Progress report.** (North Carolina State Univ., Raleigh (USA)). 17 Jan 1978. 10p. NTIS, PC A02/MF A01.

The progress between April 1974 and October 1977 of a noise-reduction program for the textile industry was reviewed. The goals of the program included: collecting noise-control information and data on effective noise-control measures; conducting noise-control research; publishing bulletins and papers; and compiling a noise-control manual. Over 50 industry noise control case histories were collected; noise-control research on spinning, twisting, and weaving was planned and conducted; a cooperative program was established between textile manufacturers, machinery builders, and equipment suppliers to conduct field evaluations of noise-control measures; research results were disseminated through publications and at meetings; and a manual was compiled for noise-control in the textile industry. Significant results of the noise-reduction research studies were listed.

3673 **(PB—88-241567/XAB) Administration of the Radiation Control for Health and Safety Act of 1968, Public Law 90-602, (1987 annual report). Report for January-December 1987.** (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). 1 Apr 1988. 77p. (FDA/CDRH—88/41). NTIS, PC A05/MF A01.

See also PB—87-215828.

This document is an annual report submitted to the President for transmittal to the Congress. The Food and Drug Administration, through its Center for Devices and Radiological Health, is responsible for the day-to-day administration of the Radiation Control for Health and Safety Act of 1968. The report provides a summary of the operations of the Center in carrying out that responsibility for calendar year 1987. In reviewing the operations of the CDRH as reported in the document, it should be kept in mind that the day-to-day administration of the Act is only part of the Center's function. Other responsibilities include the administration and enforcement of the 1976 Medical Device Amendments to the Federal Food, Drug, and Cosmetic Act (not covered in the report). Manufacturers of electronic products are required by 21 CFR 1002.20 to report accidental radiation occurrences to the CDRH. The Center no longer maintains a Radiation Incidents Registry, since accidental radiation occurrences are reported through the Device Experience Network (DEN) and through the requirements of the Medical Device Reporting (MDR) regulations.

3674 **(PB—88-247952/XAB) Animal model to study the effects of noise on humans. Final report, 1 March 1979-31 May 1982.** Nielsen, D.W.; Elliott, D.N.; Hunter-Duvar, I. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 1982. 33p. NTIS, PC A03/MF A01.

An appropriate animal model was sought to study the effects of long-term noise exposure on the inner ear of humans. The growth of temporary threshold shift (TTS) for human volunteers and squirrel monkeys was investigated, and the effects of synthetic and factory (stamping mill and stall wrench) noise on the hearing of each were studied. Attempts were also made to measure growth and frequency spread of TTS following exposure to five industrial noises that varied in spectral and temporal characteristics, enabling a comparison to be made of the effect of these noises on the hearing of humans and squirrel monkeys. The effects of selected noises presented at high intensities on the inner ear of the squirrel monkey were studied by means of light and electron microscopy. The authors concluded that as an animal model, the squirrel monkey may overestimate human TTS in the 500-Hz to 1-kHz range and underestimate it at 5.6kHz. The underlying causes of the TTS at frequencies other than 500-Hz to 1-kHz may be similar for the two species.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 2813, 2875, 3559

3675 **(INIS-BR—1280) Geochronological determination of the pegmatites from Rio de Janeiro State.** Oliveira Menezes, S. de; Cordani, U.G.; Teixeira, W. (Universidade Federal Rural do Rio de Janeiro (Brazil); Sao Paulo Univ. (Brazil)). (Sociedade Brasileira de Geologia, Sao Paulo). 1987. 18p. (In Portuguese). (CONF-8708290—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704523/JAW.

From 1. symposium on regional geology RJ-ES; Rio de Janeiro, Brazil (1 Aug 1987).

Samples of muscovite and plagioclase were collected from the pegmatites located in the counties of Niteroi and Sao Goncalo, State of Rio de Janeiro. Geochronological Research Center of the University of Sao Paulo has selected some samples for pottasium-argon and rubidium-strontium analysis. Three samples of muscovite analysed by K-Ar dating method lave ages between 437+-13 and 447+-16 m.y and two others, by Rb-Sr dating method, gave 495+-15 and 500+-13 m.y.. One sample of plagioclase analysed by K-Ar method gave age of 337+-16 m.y.. In this paper, the locations of the analysed samples are described and the samples of vicinity are listed in the Appendix. Interpretation of the radiometrio ages and discussion of results are made. Taking into account the results of Table 1 and the geologic setting of the pegmatities sample in Niteroi and Sao Goncalo, we way conclude that all cooling ages (440-550 m.y.) are related to the Brasiliano Orogeny. These pegmatites are regard as having same geological history and their ages are supposed 500 m.y..

3676 **(INIS-BR—1291) Chronology of Caatinga formation in the Salitre river basin by radioactive disequilibrium in the uranium series.** Azevedo, A.M.R. de. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704533/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

5802 Geophysics

REFER ALSO TO CITATION(S) 2930

3677 **(EPRI-NP—6074) Engineering model of earthquake ground motion for eastern North America: Final report.** McGuire, R.K.; Toro, G.R.; Silva, W.J. (Electric Power Research Inst., Palo Alto, CA (USA); Risk Engineering, Inc., Golden, CO (USA)). Oct 1988. 191p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002058/JAW.

This study reviews available earthquake ground motion data from eastern North America (ENA), interpretations of seismic source spectra and attenuation in ENA, and empirical and analytical studies of the effects of surficial geology on ground motion. The current state of knowledge in these areas is synthesized into a set of equations that can be used to predict strong seismic shaking for rock in ENA. These equations capture the uncertainty in current, alternative theories on seismic source spectra and scaling, in the form of multiple estimates with weights. Site-amplification factors are developed for 5 site categories and for various amplitudes of ground motion, using an equivalent linear model. The equations and site factors obtained here can be used for general analysis of seismic hazards in ENA. 80 figs., 17 tabs.

3678 **(PB—88-252747/XAB) Building collapse: a literature survey.** Broberg, M. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Jun 1988. 49p. (In Swedish). (FOA-C—20721-2.6). NTIS, PC E03/MF A01.

A survey of the literature registered in data bases resulted in some 60 references on building collapses. The literature is divided into the following categories according to the reason for collapse: earthquakes, explosions caused by accidents, explosions of conventional and nuclear weapons, and abnormal loading. The references give limited information about clearance after building collapses, except for those caused by nuclear attacks. There is a lack of sources which concern one of the survey's main objectives, i.e., clearance after an attack by conventional weapons. Documentation is also limited concerning the characteristics of debris as well as the spread of fire in debris.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 3261, 3680, 3681, 3682, 3683, 3684, 3685, 3686

3679 **(LBL—25655) Borehole breakout and stress measurements.** Zheng, Ziqiong; Cook, N.G.W.; Meyer, L.R. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). May 1988. Contract AC03-76SF00098. 9p. (CONF-880654—13). NTIS, PC A02/MF A01. Order Number DE89002923/JAW.

From 29. U.S. symposium on rock mechanics; Minneapolis, MN, USA (13 Jun 1988).

Elongated breakout cross sections for different rock stresses and strengths have been produced using a numerical simulation based on boundary element methods and a micromechanics model of extensile splitting. Although these breakout cross sections are completely stable for an elastic-brittle rock they are not related uniquely to the stresses and strengths, and depend upon the sequence in which holes are drilled and the stresses applied. The depth of any breakout depends mainly on the initial breakout angle. The same initial breakout angle can result from many different combinations of stress. We conclude that breakout shapes cannot be used to infer the magnitudes of the stresses orthogonal to a borehole. The interpretation of hydraulic fracturing measurements based on the stress around a circular hole does not result in large errors if the hole has moderate breakouts. Large breakouts result in tensile fractures that preclude measurements of breakdown pressures. 24 refs., 5 figs.

5804 Geochemistry

3680 **(INIS-BR—1312) Geochemical pattern of rare-earth elements from ore deposits of Sete Barras and Volta Grande-PR.** Ronchi, L.H.; Dardenne, M.A. (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 15p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704551/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The fluorite ore deposits of Volta Grande and Sete Barras in Parana show similar REE distribution patterns. Fluorite ores from other regions in Parana e Santa Catarina show marked differences in the REE pattern which suggest different modes of origin.

3681 **(INIS-BR—1313) Geochemical characterization of rare earth elements from fluorite deposits of Tangua district - RJ.** Coelho, C.E.S.; Dardenne, M.A. (Brasilia Univ. (Brazil)). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 22p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704552/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The Tangua fluorite vein-type deposits are related to an alkaline complex of the same name, and situated in the District of Itaborai, in the State of Rio de Janeiro. The plutonic body of nepheline syenites (Tangua Massif) intrudes basement gneisses, with dykes and sills of trachitic and phonolitic nature of hundreds of meters in length and centimeters to tens of meters in thickness. The fluorite veins are emplaced both in gneisses and alkaline rocks (plutonic body and dykes) in NE-ENE structures created or reactivated during the opening of the South Atlantic Ocean. The geochemical study of rare earth elements reveals that these mineralizations show very low contents in these elements, and a relatively high fractionation spectres. In the deposit environment, four mineralization phases were differenciated, with the first one being considered as the initial solution; the second one characterized by a new europium rich-solution; the third one, representing the evolution of this new solution, but in a reducing environment, with precipitation of pyrite; and the last one, representing a new batch of the initial solution. As a consequence of the REE's and fluid inclusions studies, we are able to suggest an origen by weathering of the country rocks due to superficial meteorics solutions along faults and fractures, that when heated in deep environments, promote lixiviation of silica and fluorine and precipitate the fluorites when their ascending movement comes to an end.

3682 **(INIS-BR—1314) Distribution of rare-earths in solid solution crandalita- goyazita of Sapucaia (Bonito-Para).** Costa, M.L. da; Melo Costa, W.A. de. (Para Univ., Belem (Brazil)). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 18p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704553/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The Crandallite are predominant in the lateritic phosphates of Sapucaia, in the form of the solid solution Crandallite (Cn)-Goyazite (Gz)-Florencite (Fl). The Crandallite-Goyazite is predominant, where the maximum proportion of Florencite is Cn/sub 60/Cz/sub 34.8/Fl/sub 5.2/- This proportion of Florencite is relatively high for laterites, and for this case having up to 1,374% weight of TR/sub 2/O/sub 3/ in the total sample. The light rare elements are predominant over the heavy ores, and are illustrated in the distribution curve normalized for the chondrites. This curve is partially comparable with the curve for Apatite presents slight negative anomaly for the element Europium, and slight positive anomaly for The elements Thulium. The geochemical caracteristics for the rare earths in this group allow the prediction for the original rock for the laterites.

3683 **(INIS-BR—1315) Distribution of rare-earth elements in a lateritic bauxite profile on an alkaline rock-Passa Quatro massive.** Sigolo, J.B.; Boulange, B.; Muller, J.P.; Schmitt, J.M. (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 12p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704554/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The distribution of the REE (La, Ce, Nd, Sm, Eu, Gd, Dy, Er, Yr and Lu) in a lateritic bauxitic profile indicates that they have been remobilized during weathering of a nepheline syenite, with a contrasting behaviour of LREE and HREE both in the the bauxite and argilaceous matrix. The REE fractionation increases towards the top of the profile and these elements are more concentrated in the bauxite than in the matrix. The REE patterns normalized to chondrite and to the fresh rock indicate that Ce is strongly enriched and the LREE are strongly depleted and the HREE are progressively less depleted, with Yd and Lu being enriched, in the alteration products.

3684 **(INIS-BR—1316) Partition of rare-earths in phosphates laterites from Maicuru, Brazil - PA.** Lemos, V.P.; Costa, M.L. da. (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 21p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704555/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The phosphatic laterites of Maicuru-Para are formed of aluminium phosphates, mainly of the crandallite group, followed by wardite, augellite and senegallite. The crandallite group is represented in the form of the solid solution goyazite-florencite-crandallite, in variable proportions. In three samples, the florencite occurs as the predominant member, while in the others crandallite is the main mineral. The unit-cell dimension of florencites, in two samples, measured are the same as those of the florencites from other deposits. The rare earths occur mainly in this mineral group with predominance of the light rare earth elements. This is well observed in the condrite normalized REE patterns. These enrichments are not regular. The geochemical characteristics of the rare earth distribution in the crandallites of Maicuru, leads tho suggest this mineral was formed from distinct lithologies.

3685 **(INIS-BR—1317) Isotope ratio 87Sr/86Sr in limestones from Bambui group, Brazil (MG).** Kawashita, K.; Mizusaki, A.M.P.; Kiang, C.H. (Sao Paulo Univ. (Brazil); PETROBRAS, Rio de Janeiro (Brazil). Centro de Pesquisas). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 6p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704556/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The Sr composition of ancient seawater can be estimated from the analysis of carbonate rocks and, in some cases, used to estimate the age of the analyzed carbonate. The normalized 87Sr/86Sr ratios in calcium carbonate fractions from 14 core samples in the Bambui Group near Montalvania, MG, were found to range between .7077 and .7280. The higher values are attributable to Sr isotopic exchange between silicate and carbonate phases during diagenesis. The ratio of .7077 obtained in two pure calcium carbonate samples is here suggested as the best aproximation for the 87Sr/

86Sr value for the Bambui sea. This ratio is compatible with an age of about 700 Ma., estimated from the published 87Sr/86Sr curve of Veizer and others, an age in accordance with Quadros recent (1987, in preparation) identification of marine acritarchs from the latest Precambrian (Vendian).

3686 **(INIS-BR—1318) Geochemical geochronology and genesis of granite from Coronel Murta, Northeast of Minas Gerais, Brazil.** Soares, A.C.P.; Siga Junior, O. (Minas Gerais Univ., Belo Horizonte (Brazil); Sao Paulo Univ. (Brazil)). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 12p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704557/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

Geological, petrographic, geochemical (including rare-earth elements) and geochronological data of the Coronel Murta (Northeast Minas Gerais State) post-tectonic intrusive alkalic granites were summarized in order to discuss their genesis. This paper shows that Coronel Murta granites were generated by anatexis of dominantly metasedimentary rocks, in an ensialic environment, as the late results of an intraplate A-type subduction during the Brazilian Cycle.

3687 **(PNL-SA—16304) Increased temperature competence of MINTEQ.** Smith, R.W.; McKinley, J.P. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 15p. (CONF-8810200—1). NTIS, PC A03/MF A01. Order Number DE89001735/JAW.

From 4. annex VI experts meeting; Helsinki, Finland (12 Oct 1988).

The MINTEQ geochemical computer code was developed to model water/rock equilibria at near-ambient temperatures. The development of the thermodynamic data base has paralled this emphasis on low- temperature applications. The application of MINTEQ to calculations for elevated-temperature ATES systems is therefore limited. To enhance the usefulness of MINTEQ for calculations for ATES systems, coefficients and equations for calculating mineral hydrolysis constants, solubility products, and formation constants for 60 minerals and 57 aqueous species in the 13-component thermodynamic system K_2O-Na_2O-CaO-MgO-FeO-Al_2O_3-SiO_2-CO_2-H_2O-HF-HCl-H_2S-H_2SO_4 have been derived. These modifications to the code and data base allow equilibrium calculations for temperatures of up to 300{degree}C to be made.

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6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 3730, 3955

3688 **(AD-A—196976/5/XAB) Three probable stellar-mass black holes. Master's thesis.** Fry, D.W. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 62p. (AFIT/CI/NR—88-111). NTIS, PC A04/MF A01.

According to the theory of general relativity, a spherically symmetric self-gravitating body whose radius/mass ratio in Schwarzchild coordinates decreases to the critical value of 2 must collapse to a point singularity. Such an object is termed a black hole, since out to a characteristic radius known as the event horizon, not even photons can escape its strong gravitational field. It has been postulated that such a field could serve to compress and heat accreting gas, which would then emit soft x rays, signalling the black hole's presence. One accretion model is that of a black hole in binary orbit with a normal luminous star which is ejecting part of its mass, some of which is captured by the companion black hole and emits x rays before disappearing inside the event horizon. Objects consisting of degenerate nuclear matter known as neutron stars, and whose existence has been well established, could also serve as the x ray companion in such a system. One way to distinguish between a neutron star and a black hole is to measure their mass, for if casualty is to be preserved, a neutron star cannot exceed about 3 solar masses, while the mass of a black hole is arbitrary. A lower limit on the mass of the x-ray emitter in a binary system can be determined if the orbital period, projected orbital velocity, and mass or radius of the luminous companion star can be measured via conventional astronomical methods. Presently, three binary systems so appear to contain an x-ray emitter whose mass exceeds 3 solar masses and must likely be a black hole. They are Cygnus X-1, LMC X-3, and A0620-00.

3689 **(IC—88/150) Lower bound of energy dissipation in isothermal shocks in black hole accretion and winds.** Chakrabarti, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704708/JAW.

We show that there is a lower limit of the change in energy density $\Delta\epsilon=\epsilon/\text{sub } -/-\epsilon/\text{sub } +/$ of thin, adiabatic, rotating flows while crossing isothermal shocks ($T/\text{sub } -/=T/\text{sub } +/$) (- and + signs denote the quantities before and after the shock). This limit depends upon the flow parameters such as the energy density and the angular momentum of the flow and is given by, $\Delta\epsilon \geqq /\text{sup } 2/// \text{sub } \gamma(\text{sup } 2)/ \text{ a/sub c//sup } 2/(x/\text{sub c/})C\sqrt{C/\text{sup } 2/-\gamma}$. Here, a/sub c/(x/sub c/) is the sound speed at the outermost critical point and $C=\gamma M+1/M$, an invariant function across the shock, M is the Mach number of the flow and γ is the adiabatic index. (author). 5 refs, 1 fig.

3690 **(IC—88/151) Standing non-dissipative shocks in black hole accretion and winds.** Chakrabarti, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704709/JAW.

We present all non-dissipative shock solutions for stationary, axially symmetric and rotating adiabatic flows of small transverse thickness in black hole potential. We show that for a given initial and final states of the flow, there can be as many as four formal shock locations in both the accretion and the winds. Only two (three) of these locations are acceptable for accretion onto black holes (neutron stars) and three of these locations are acceptable for winds. We prove that the shock strength and the temperature jump have a lower limit which does not depend upon the parameters of the flow or the force field in which the flow moves and is only a function of the adiabatic index of flow. (author). 14 refs, 12 figs.

3691 **(IC—88/152) Lower limit of stationary shock strength in adiabatic flows.** Chakrabarti, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704710/JAW.

We show that there is a lower limit of the shock strength $\Sigma=/\text{sup (sup M)-///sub M(sub +)/}$, where M/sub -/ and M/sub +/ are the Mach numbers before and after the shock, for adiabatic flows in vertical equilibrium. The limit is independent of the nature of the force field governing the flow or the mass flux and only depends upon the adiabatic index. (author). 3 refs, 2 figs.

3692 **(IC—88/153) Isentropic compression waves in black hole accretion and winds.** Chakrabarti, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704711/JAW.

We present all the isentropic shock solutions for stationary, axially symmetric and rotating adiabatic flows of small transverse thickness in black hole potential. We classify the whole parameter space spanned by the accretion rate, energy and the angular momentum of the flow in terms of the number of shock solutions. We show that in some regions of the parameter space, as many as four such solutions exist for all of which the dissipation of energy remains the same but the shock strength varies. We calculate the shock locations and the shock strengths for the whole parameter space. We show that the shocks cannot be arbitrarily weak. The lower limit of shock strength is independent of any of the flow parameters, and depend solely upon the adiabatic index. (author). 7 refs, 13 figs.

3693 (IC—88/160) Liouville's equation: III. Symmetries of the linearized equation. Sobouti, Y.; Samimi, J. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704715/JAW.

Let the linearized Liouville-Poisson equation be iδf/δt=Af,f=f(q,p),p= momentum coordinate. A on f's is not a Hermitian operator. However, an eigenvalue equation Af/sub w/=wf/sub w/, with real w's and non orthogonal eigenfunctions can be set up. For spherically symmetric potentials A and A/sup 2/ have 0(3) symmetry. There exists an angular momentum operator, J/sub i/, which commutes with A. This classifies the eigenfunctions into classes specified by a pair of eigennumbers (j,m) belonging to (J/sup 2/,J/sub z/). This in turn enables one to separate the dependence of the eigenfunctions on the direction angles of (q,p) and reduce the six dimensional phase space problem into a two dimensional one in terms of the magnitudes (q,p). (author). 19 refs.

3694 (IC—88/187) Standing isothermal shocks in adiabatic black hole accretion and winds. Chakrabarti, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704731/JAW.

We present all the solutions for the isothermal standing shocks in the stationary, axially symmetric, transonic, adiabatic flows with polytropic, rotating fluid configurations of small transverse thickness in the black hole geometry. We show that these shocks dissipate both the energy and the entropy. The lower limits of shock dissipation and shock strength are derived and the detailed nature of the energy loss at the shock and the location of the shock are provided for the whole parameter space spanned by the initial energy, the accretion rate and the angular momentum of the flow. We show that up to two per cent of the rest mass energy can be radiated away at the shock. (author). 7 refs, 9 figs.

3695 (IC—88/216) Equilibrium configuration for an inertially dragged viscous fluid around a slowly rotating compact object. Prasanna, A.R. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704741/JAW.

It is shown that physically meaningful fluid distributions in the form of a thin disk around a rotating compact object can exist in equilibrium where the angular velocity of the fluid is entirely due to the dragging induced by the space-time surrounding the compact object. The pressure balance at the inner edge is mainly due to the equality of the radiation pressure and the hydrostatic gas pressure. If there is no bulk viscosity the pressure remains constant throughout the disk whereas with increasing bulk viscosity the pressure drops in the inner regions but soon stabilizes at an almost constant value. (author). 4 refs, 9 figs.

3696 (IC—88/252) Standing shocks in adiabatic black hole accretion of rotating matter. Abramowicz, M.A.; Chakrabarti, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704756/JAW.

We present all the solutions for stationary, axially symmetric, transonic, adiabatic flows with polytropic, rotating fluid configurations of small transverse thickness, in an arbitrarily chosen potential. Special attention is paid to the formation of the standing shocks in the case of black hole accretion and winds. We point out the possibility of three types of shocks depending upon three extreme physical conditions at the shocks. These are: Rankine-Hugoniot shocks, isentropic compression waves, and isothermal shocks. We write down the shock conditions for these three cases and discuss briefly the physical situations under which these shocks may form. A complete discussion on the properties of these shocks will be presented elsewhere. (author). 21 refs, 4 figs.

3697 (IC—88/254) Systematic study of the standing shocks in astrophysical flows near a compact object. Chakrabarti, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704758/JAW.

We study the standing dissipative and non-dissipative shocks and the isentropic compression waves systematically in the thin, rotating, adiabatic astrophysical flows, such as accretion or winds, near the black holes and the neutron stars. The flow is assumed to be in transverse equilibrium and the dissipation is allowed only at the shocks. We classify the whole parameter space spanned by the accretion rate M, the energy E and the angular momentum λ according to whether a shock solution can exist or not. Apart from conserving the baryon flux and the net momentum flux, flows at these discontinuities (collectively refered to as shocks) may conserve energy (Rankine-Hugoniot shocks), entropy (isentropic compression waves), or just be isothermal (isothermal shocks) according to three extreme physical processes which may take place near the shocks. We also show that for a given pre-shock and the post-shock parameters the shock locations are not unique. We derive an invariant Mach number relation at the shock and from this show that the shocks cannot be arbitrarily weak. The lower limit of the shock strength is independent of the initial parameters of the flow and the governing force field, but depends only upon the adiabatic index of the flow. We perform the local stability analysis to show that some of the shocks are unstable. In most of the cases the local analysis is not able to resolve the issue of the non-uniqueness of the shock locations. (author). 13 refs, 13 figs.

3698 (LA-UR—88-3336) Cosmic-ray interactions and dating of meteorite stranding surfaces with cosmogenic nuclides. Reedy, R.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8807120—1). NTIS, PC A02/MF A01. Order Number DE89002043/JAW.

From Workshop on Antarctic meteorite stranding surfaces; Pittsburgh, PA, USA (13 Jul 1988).

A wide variety of products from cosmic-ray interactions have been measured in terrestrial or extraterrestrial samples. These "cosmogenic" products include radiation damage tracks and rare nuclides that are made by nuclear reactions. They often have been used to determine the fluxes and composition of cosmic-ray particles in the past, but they are usually used to study the history of the "target" (such as the time period that it was exposed to cosmic-ray particles). Products made by both the high-energy galactic cosmic rays and energetic particles emitted irregularly from the Sun have been extensively studied. Some of these cosmogenic products, especially nuclides, have been or can be applied to studies of Antarctic meteorite stranding surfaces, the ice surfaces in Antarctica where meteorites have been found. Cosmogenic nuclides studied in samples from Antarctica and reported by others elsewhere in this volume include those in meteorites, especially radionuclides used to determine terrestrial ages, and those made in situ in terrestrial rocks. Cosmogenic nuclides made in the Earth's atmosphere or brought in with cosmic dust have also been studied in polar ice, and it should also be possible to measure nuclides made in situ in ice. As an introduction to cosmogenic nuclides and their applications, cosmic rays and their interactions will be presented below and production systematics of cosmogenic nuclides in these various media will be discussed later. 20 refs., 2 tabs.

3699 (N—88-27998) Cascade model of gamma-ray bursts: power-law and annihilation-line components. Harding, A.K.; Sturrock, P.A.; Daugherty, J.K. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Aug 1988. 27p. (NASA-TM—101176; NAS—1.15:101176; CSSA-ASTRO—88-13). NTIS, PC A03/MF A01.

If, in a neutron star magnetosphere, an electron is accelerated to an energy of 10 to the 11th or 12th power eV by an electric field parallel to the magnetic field, motion of the electron along the curved field line leads to a cascade of gamma rays and electron-positron pairs. This process is believed to occur in radio pulsars and gamma ray burst sources. Results are presented from numerical simulations of the radiation and photon annihilation pair production processes, using a computer code previously developed for the study of radio pulsars. A range of values of initial energy of a primary electron was considered along with initial injection position, and magnetic dipole moment of the neutron star. The resulting spectra was found to exhibit complex forms that are typically power law over a substantial range of photon energy, and typically

include a dip in the spectrum near the electron gyro-frequency at the injection point. The results of a number of models are compared with data for the 5 Mar., 1979 gamma ray burst. A good fit was found to the gamma ray part of the spectrum, including the equivalent width of the annihilation line.

3700 **(N—88-28835) Reports of planetary astronomy, 1988.** (National Aeronautics and Space Administration, Washington, DC (USA)). Aug 1988. 178p. (NASA-TM—4063; NAS—1.15:4063). NTIS, PC A09/MF A01.

A compilation is presented of abstracts of reports from Principal Investigators funded through NASA's Planetary Astronomy Program, Office of Space Science and Applications. It provides a summarization of work conducted in this program for 1988. Each report contains a brief statement on the strategy of investigation and lists significant accomplishments within the area of the author's funded grant or contract, plans for future work, and publications.

3701 **(N—88-28843) International ultraviolet explorer spectral atlas of planetary nebulae, central stars, and related objects.** Feibelman, W.A.; Oliversen, N.A.; Nicholsbohlin, J.; Garhart, M.P. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1988. 380p. (NASA-RP—1203; NAS—1.61:1203). NTIS, PC A17.

The International Ultraviolet Explorer (IUE) archives contain a wealth of information on high quality ultraviolet spectra of approximately 180 planetary nebulae, their central stars, and related objects. Selected are representative low-dispersion IUE spectra in the range 1200 to 3200 A for 177 objects arranged by Right Ascension (RA) for this atlas. For most entries, the combined short wavelength (SWP) (1200to 1900) and long wavelength (LWR) (or LWP, 1900 to 3200 A) regions are shown on 30 cm by 10 cm Calcomp plots on a uniform scale to facilitate intercomparison of the spectra. Each calibrated spectrum is also shown on an expanded vertical scale to bring out some of the weaker features.

3702 **(PB—88-240403/XAB) Solar-Geophysical Data Number 526, June 1988. Part 1 (prompt reports). Data for May 1988, April 1988, and late data.** Coffey, H.E.; McKinnon, J.A. (National Geophysical Data Center, Boulder, CO (USA)). Jun 1988. 117p. (SGD—526-PT-1). NTIS, PC A06/MF A01.

See also Number 526, Part 2, PB—88-240411, and Number 523, Part 1, PB—88-212766.

Contents include: detailed index for 1987 and 1988; data for May 1988--(IUWDS alert periods (advance and worldwide), solar-activity indices, solar flares, solar radio emission, Stanford mean solar magnetic field); data for April 1988--(solar-active regions, sudden ionospheric disturbances, solar radio-spectral observations, cosmic-ray measurements by neutron monitor, geomagnetic indices); and late data--(Pioneer XII interplanetary magnetic field -- November 1987, geomagnetic indices -- March 1988).

3703 **(PB—88-240411/XAB) Solar-Geophysical Data Number 526, June 1988. Part 2 (comprehensive reports). Data for December 1987.** Coffey, H.E.; McKinnon, J.A. (National Geophysical Data Center, Boulder, CO (USA)). Jun 1988. 43p. (SGD—526-PT-2). NTIS, PC A03/MF A01.

See also Number 526, Part 1, PB—88-240403, and Number 523, Part 2, PB—88-212774.

Contents include: detailed index for 1987 and 1988; data for December 1987--(Meudon Carte Synoptique, solar flares, solar radio bursts at fixed frequencies, solar x-ray radiation from GOES satellite, mass ejections from the sun, and active prominences and filaments).

3704 **(UCRL—99643) Relativistic shocks in electron-positron plasmas, and polar cap accretion onto neutron stars: Two non-linear problems in astrophysical plasma physics.** Arons, J. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1988. Contract W-7405-ENG-48;AC03-76SF00098. 8p. (CONF-8808150—1). NTIS, PC A03/MF A01. Order Number DE89001133/JAW.

From Varenna-Abastumani workshop on plasma astrophysics; Varenna, Italy (24 Aug 1988).

I outline particle simulations and theory of relativistic shock waves in an e/sup +-/ plasma. Magnetic reflection of particles is an essential role in the shock structure. Instability of the reflected particles in the shock front produces intense extraordinary mode radiation. Such shocks are candidates for the particle accelerator in plerions and in extragalactic jets only if the upstream Poynting flux composes no more than 10% of the total. I summarize analytical and numerical studies of radiation dominated accretion onto the magnetic poles of neutron stars. The upper limit to the photon luminosity depends upon magnetic confinement, not upon the dragging of photons into the star. Numerical solutions show the plasma forms large scale "photon bubbles." I suggest the percolative loss of radiation controls the pressure and therefore the limits of magnetic confinement. Loss of magnetic confinement through resistive interchange instability is suggested as a means of generating TeV to PeV voltage drops along the magnetic field. 34 refs., 6 figs., 1 tab.

3705 **Electron temperature and optical emission structure of the central component of CTB 80.** Blair, W.P.; Fesen, R.A.; Becker, R.H. (Johns Hopkins Univ., Baltimore, MD (USA); Colorado Univ., Boulder (USA); California Univ., Davis (USA); Lawrence Livermore National Lab., CA (USA)). *Astronomical Journal;* **96**: 1011-1018(Sep 1988).

Optical spectra on the central component of the galactic supernova remnant CTB 80 are presented. Long slit CCD spectra reveal relative line-intensity variations among individual filaments, the presence of Balmer-dominated emission in the core's east and west optical lobes, and no radial velocities in excess of 300 km/s. Aperture spectrophotometry of the temperature-sensitive forbidden O III lines suggests Te = 25,000 K, thus favoring a shock-heated interpretation for the remnant's optical core emission. These results indicate that fundamental differences exist betweem the optical emission of CTB 80's central core component and the Crab Nebula, despite similarities in these remnants' radio and X-ray properties. The optical emission from CTB 80's core is likely to be a direct result of the interaction of an active pulsar with its adjacent partially neutral interstellar medium. The size of CTB 80's outer structure and the absence of either high velocity or enhanced abundances in the region local to CTB 80's pulsar argue for a considerably larger age for CTB 80 than the Crab Nebula's 1000 yr. A qualitative picture for CTB 80 that can plausibly explain many of the core's properties is proposed. 42 references.

3706 **Sm-151 branching - a probe for the irradiation time scale of the s-process.** Beer, H.; Macklin, R.L. (Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.); Oak Ridge National Lab., TN (USA)). *Astrophysical Journal;* **331**: 1047-1057(Aug 1988).

The excitation functions for the reactions Gd-152(n,gamma), Gd-154(n,gamma), Gd-155(n,gamma), and Gd-157(n,gamma) have been measured over the neutron energy range of 3-500 keV. Maxwellian-averaged capture cross sections for thermal energies kT = 5-100 keV have been calculated. At kT = 30 keV, sigma(Gd-152) = 1003 + or - 30 mbarns, sigma(Gd-154) = 878 + or - 27 mbarns, sigma(Gd-155) = 2721 + or - 90 mbarns, and sigma(Gd-157) = 1355 + or - 39 mbarns were found. The data, in conjunction with other cross sections and solar abundances, were used to carry out an s-process analysis of the branchings in the Sm-to-Gd mass range. The s-process is treated in the classical, as well as in the pulsed, model. The solution of the classical model is contained in the pulsed model as the asymtotic solution for large pulse widths. It is shown that this solution is the only one which can reproduce the abundance pattern of the different branchings. Pulse durations are limited to values larger than about 3 yr. 36 references.

3707 **Detection of abundant molecular gas in the UV-excess quasar Mrk 1014.** Sanders, D.B.; Scoville, N.Z.; Soifer, B.T. Pasadena, CA; California Institute of Technology (1988). 15p. NTIS, PC A03/MF A01.

Carbon dioxide (1 yields 0) emission has been detected from the UV-excess quasar Mrk 1014 (=PG 0157+001=IRAS 01572+0009) at z=0.163. Assuming the same empirical relationship between CO brightness and H2 surface mass density as has been found for giant molecular clouds in the Milky Way, the mass of H2 gas is approximately 4 x 10 tc the 10th solar masses, i.e., more than

ten times the H2 content of our Galaxy. The infrared and molecular gas properties of Mrk 1014 are similar to other warm, ultraluminous infrared galaxies such as Mrk 231, and IRAS 15206+3342 (z=0.125) from which CO(1 yields 0) emission is also reported. The trigger for the intense infrared activity in both Mrk 1014 and IRAS 15206+3342 appears to be a recent galaxy merger. It is suggested that objects such as these represent an important link in the evolution of ultraluminous infrared galaxies into UV-excess quasars.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 3702

3708 **(AD-A—196482/4/XAB) Search for wave-induced particle precipitation from lightning and transmitter sources. Master's thesis.** Lundberg, J.E. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 120p. (AFIT/CI/NR—88-10). NTIS, PC A06/MF A01.

Wave-induced particle precipitation is introduced and examined for whistlers whose sources are within the plasmapause. The possible correlation between lightning strokes that carry positive charge to the ground and the observed Trimpi events is discussed, sudden phase and/or amplitude shifts of a received VLF signal with gradual return to predisturbed values. The thunderstorm charging mechanisms that lead to the observed charge distribution and the advection of the positively charged cirrus anvil away from the body of the thunderstorm are briefly examined. The comparative current strengths and the relative frequency of positive and negative strokes is studied for different types of thunderstorms. The magnetospheric ducting of the lightning-generated whistler wave and the interaction with trapped electrons is examined. The detectable effects the precipitating electrons have on the ionosphere is introduced. Included are testing and design of the x-ray detector and balloon-launch considerations. The problems encountered during the x-ray-detector's balloon flights are examined. The riometer and x-ray-detector data-analysis methods are mentioned. The results were negative for the data analyzed, but the limiting factors severely restricted the usable data. Possible experimental methods are mentioned.

3709 **(AD-A—196683/7/XAB) Time-dependent model for the low-latitude ionosphere. Master's thesis.** Wells, G.D. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 112p. (AFIT/CI/NR—88-24). NTIS, PC A06/MF A01.

The theoretical development of a time-dependent, self-consistent model of the low-altitude ionosphere between 200 and 3000 km is presented. This model solves the coupled continuity-momentum and energy equations for an ionosphere composed of two ion species (O^+ and H^+) and electrons in a quasi-simultaneous manner. Account is taken of effects due to the curvature of the field lines and the inclination of the field line to the vertical. This model allows for electrodynamic drift of the plasma during the day, effects due to the expansion and contraction of the neutral atmosphere, and ion-neutral drag effects, as well as the transfer of momentum through collisions, conduction parallel to B, frictional heating/cooling due to the relative motion between the ions and the neutrals, and effects due to adiabatic expansion and contraction. Modeling capabilities are improved by including more realistic neutral winds and electric fields. The offset in the geographic and geomagnetic poles is allowed for by mapping the neutral winds and time (both organized in the geographic coordinate system) into the magnetic reference frame. Results from this model are shown to reproduce the important physical processes that are unique to the low-altitude ionosphere, such as the depletion of plasma at the magnetic equator due to electrodynamic drifts and diffusion, and the seasonal anomaly.

3710 **(INIS-BR—1273) Measurements of additional X-ray flux in South Atlantic magnetic anomaly region.** Martin, I.M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). 1968. 79p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704265/JAW.

The purpose of this study is the calculation of the additional X-ray flux (20 - 150 KeV), produced by electron precipitation in the South Atlantic anomaly region. The kind of detector and the technique employed in the observations of this flux, utilizing stratospheric balloons as a means of transport of the payload across the anomaly region, are described. The results of two balloon launchins in Sao Jose dos Campos in July 1968, with the expected flux, are compared.

3711 **(INIS-BR—1290) Langmuir parametric instabilities in spatial plasmas.** Chian, A.C.-L.; Correa, R.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704532/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

3712 **(INIS-BR—1299) In-situ plasma bubble observations associated with equatorial spread-F over Natal - Brazil.** Muralikrishna, P.; Abdu, M.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704539/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

3713 **(JINR-R—2-88-19) Modelling of narrow air showers.** Arkhestov, G.Kh.; Beshtoev, Kh.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation; AN SSSR, Moscow. Inst. Yadernykh Issledovanij). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1988. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704863/JAW.

The investigation is devoted to calculation of distribution of a fraction of full number of particles in a (maximum) detector for the thresholds N/sub c/ $\geqq$ 170 and N/sub c/ $\geqq$ 625 relativistic particles. The comparison with the experimental data is presented. 9 refs.; 2 figs.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 3256, 3257, 3258, 3286, 3891, 3975

3714 **(AD-A—196710/8/XAB) Additional sidebands in time-dependent spectra for a spatially distributed collection of two-level atoms driven by a resonant coherent field.** Ben-Aryeh, Y.; Bowden, C.M. (Army Missile Command, Redstone Arsenal, AL (USA). Research Directorate). 1 Nov 1986. 6p. NTIS, PC A02/MF A01.

Pub. in Optics Communications, Vol. 60, No. 3, 154-158(1 Nov 1986).

Time-dependent spectra of a laser-driven, interacting, collection of spacially distributed two-level atoms are derived. A system is assumed with dimensions large relative to a wavelength which is initially in the atomic and electromagnetic field ground state and at the initial time begins to interact with the coherent, externally applied radiation field. The explicit spatial distribution of the two-level atoms affects the time-dependent spectra of the transmitted radiation and the many-body interaction leads to the appearance of additional sidebands.

3715 **(BNL—41602) Nuclear reorganization barriers to electron transfer.** Sutin, N.; Brunschwig, B.S.; Creutz, C.; Winkler, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 15p. (CONF-8808130—1). NTIS, PC A03. Order Number DE88016582/JAW.

From 19. international conference on solution chemistry; Lund, Sweden (15 Aug 1988).

The nuclear barrier to electron transfer arises from the need for reorganization of intramolecular and solvent internuclear distances prior to electron transfer. For reactions with relatively small

driving force ("normal" free-energy region) the nuclear factors and rates increase as intrinsic inner-shell and outer-shell barriers decrease; this is illustrated by data for transition metal complexes in their ground electronic states. By contrast, in the inverted free-energy region, rates and nuclear factors decrease with decreasing "intrinsic" barriers; this is illustrated by data for the decay of charge-transfer excited states. Several approaches to the evaluation of the outer-shell barrier are explored in an investigation of the distance dependence of the nuclear factor in intramolecular electron-transfer processes. 39 refs., 14 figs., 3 tabs.

3716 **(DOE/ER/13860—1) Time-resolved FTIR [Fourier transform] emission studies of laser photofragmentation and chain reactions: Progress report, April 1, 1988--March 31, 1989.** Leone, S.R. (Colorado Univ., Boulder (USA)). Oct 1988. Contract FG02-88ER13860. 5p. NTIS, PC A02/MF A01. Order Number DE89002678/JAW.

A commercial Fourier transform (FTIR) spectrometer has been modified to obtain time-resolved infrared emission spectra of photofragments produced by laser dissociation. This paper discusses the use of this spectrometer on HF, CO, and CCH photodissociation from vinyl chloride, dichloroethylene, and 1,1-fluorochloroethylene.

3717 **(DOE/ER/13881—1) [Development of laser excited atomic fluorescences and ionization spectrometric methods]: Progress report, May 1, 1988-September 1, 1988.** Winefordner, J.D. (Florida Univ., Gainesville (USA). Dept. of Chemistry). 1988. Contract FG05-88ER13881. 3p. NTIS, PC A02/MF A01. Order Number DE89001904/JAW.

This paper discusses: laser excited fluorescence; ionization spectrometry in plasma; and spectral interferences in laser excited atomic fluorescence spectrometry. (LSP)

3718 **(IAE—4531/12) Kinetics of hydrogen isotope mesic atoms in excited states.** Men'shikov, L.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 19p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704686/JAW.

The mechanisms of de-excitation and acceleration of mesic atoms of hydrogen isotopes in excited states are studied. New results for Auger transitions rates are given. The energy distribution of mesic atoms for the transition to 1S state is calculated. 26 refs.; 4 figs.

3719 **(IC—88/166) Radiation induced luminescence from dipoles immersed in a solid with a rough surface.** Nkoma, J.S. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704719/JAW.

Luminescence is modelled as radiation from an oscillating dipole immersed in a solid with a rough surface. Maxwell's equations are solved and the zero order and first order electric fields in the roughness amplitude are obtained. It is found that the first order contribution becomes comparable to the zero order contribution only when the roughness amplitude is large, of the order 10,000 A. The effects of dipoles oriented parallel and normal to the z-axis are compared. Our results are applied to a system of GaP with a rough surface and bounded by vacuum. (author). 9 refs, 5 figs.

3720 **(INIS-BR—1335) Use of analytical Born amplitude representation in studies of dispersion potentials and electron-atom scattering.** Carvalho, I.L. de. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1985. 196p. (In Portuguese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704794/JAW.

Two distinct problems have been studied using simplifield Born's Amplitude Analitical Expressions. The first problem deals with the dispersion energy between the constituent members of the systems He - Ne, - He and H/sub 2/ - H/sub 2/. In the second problem second order Born Aproximation has been used for the Electron - Atom Inelastic Scattering for the transitions 1 /sup 1/S - > 2 /sup 1/S and 1 /sup 1/S -> 2 /sup 1/P of helium atom and / sup 1/ S -> 1 s/sub 2/ ([3s' {1/2} sup(o) 1; M sub(j)>) of neon atom (in the case of neon we have used the coupling scheme proposed by Cowan and Andrew). The results obtained by us have been compared with the theoretical and experimental results available in the literature.

3721 **(JINR-R—4-88-16) Effective relativistic hamiltonians of mesic molecules ddμ and dtμ.** Bakalov, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704871/JAW.

Coefficient of the effective relativistic Hamiltonian of mesic molecules ddμ and dtμ are expressed in terms of average values of the standard set of spheroidal operators Y/sub j/, and the corresponding integrals are numerically calculated in the adiabatic representation. The results obtained can be applied to estimate the accuracy of adiabatic computations of the relativistic effects in mesic molecules dtμ and ddμ. 7 refs.; 3 tabs.

3722 **(JINR-R—4-88-17) De-excitation rates of mesic molecule ddμ in mesic molecular complex (ddμ)dee.** Bakalov, D.D.; Melezhik, V.S.; Men'shikov, L.I.; Fajfman, M.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 15p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704872/JAW.

Submitted to the journal Zh. Ehksp. Teor. Fiz. .

Deexcitation is considered of the mesic molecule ddμ from a weakly bound rotational-vibrational state (J=v=1) to a state (J=1, v=0) with conversion on an electron of the mesic molecular complex ((ddμ)dee). The deexcitation rate is calculated by a perturbative expansion in the electron-interaction operator of the complex ((ddμ)dee) with mesic molecule ddμ. It is shown that the contribution of second-order terms corresponding to virtual E1-transitions of the ddμ-molecule substantially compensates for the contribution of first-order terms corresponding to E0-transition. The calculated rate λ/sub dex/=0.22x10/sup 8/ s/sup -1/ is considerably smaller than the one calculated earlier for E0-transition λ/sub 0//sup (m)/ =1.90x10/sup 8/ s/sup -1/. 21 refs.; 1 fig.; 1 tab.

3723 **Generalized Ramsauer-Townsend effect in extended x-ray-absorption fine structure.** McKale, A.G.; Veal, B.W.; Paulikas, A.P.; Chan, S.; Knapp, G.S. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **38**: No. 15, 10919-10921(15 Nov 1988).

Theoretical backscattering amplitude and phase functions, B(k) and phi(k), used in extended x-ray-absorption fine structure (EXAFS) studies show strong features in their k dependence which can be identified as a "generalized Ramsauer-Townsend effect." This effect is studied in detail for elements with atomic number $78 \leqq Z \leqq 90$.

3724 **Large area directly heated lanthanum hexaboride cathode structure having predetermined emission profile.** Leung, Ka-Ngo; Gordon, K.C.; Kippenhan, D.O.; Purgalis, P.; Moussa, D.; Williams, M.D.; Wilde, S.B.; West, M.W. US Patent Application 6-108,327. 16 Oct 1987. 14p. Contract AC03-76SF00098. DE89000184 NTIS, PC A03/MF A01. Order Number DE89000184/JAW.

A large area directly heated lanthanum hexaboride (LaB_6) cathode system is disclosed. The system comprises a LaB_6 cathode element generally circular in shape about a central axis. The cathode element has a head with an upper substantially planar emission surface, and a lower downwardly and an intermediate body portion which diminishes in cross-section from the head towards the base of the cathode element. A central rod is connected to the base of the cathode element and extends along the central axis. Plural upstanding spring fingers are urged against an outer peripheral contact surface of the head end to provide a mechanical and electrical connection to the cathode element. 7 figs

3725 **Inner shell ionization accompanying nuclear collisions.** Sujkowski, Z. (Institute for Nuclear Studies, Swierk (Poland)). pp 289-352 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

Selected phenomena leading to inner shell ionization and being of relevance for nuclear physics are discussed. The selection emphasizes the K-shell ionization induced in head-on collisions by fast light and medium-heavy ions. Cross-sections are reviewed. Effects of multiple inner shell ionization on the K X-ray spectra are illustrated with recent results. Implications for nuclear experiments are noted. Use of atomic observables as clocks for proton induced nuclear reactions is reviewed. Prospects for H.I. reactions are discussed. Preliminary experimental results on the direct K-shell ionization accompanying H.I. fusion reactions are presented. The post-collisional K-shell ionization due to internal conversion of γ-rays is discussed as the dominating contribution to the ionization for residues of dissipative nuclear reactions with $Z > 40$. Systematics of the corresponding K X-ray multiplicities are presented for rotational nuclei. These multiplicity values can be used for determining cross-sections for e.g. incomplete fusion reactions. Examples of such applications are given. Also discussed is the use of target K X-rays for normalization purposes and of the post-collisional, residue K X-rays in the studies of high spin phenomena. 96 references, 35 figures, 3 tables.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 3103

3726 **(UCID—21537) A model of shock-shock interactions in a viscous gas.** Howes, F.A. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 14p. Q/MF A01. Order Number DE89002856/JAW.

We wish to study in this paper the interaction of two weak shock waves traveling in a viscous, γ-law gas, which is assumed to be thermally non-conducting. The shock waves are obtained as solutions of a Burgers' equation that is obtained in turn by an asymptotic analysis of the fully nonlinear, one-dimensional, unsteady gasdynamic equations. This asymptotic analysis is performed under the assumption that the shocks are weak, and so they travel at a speed close to the local speed of sound in the undistured gas. Of course the replacement of the gasdynamic equations (a set of three equations expressing conservation of mass, momentum, and energy) by a single Burgers' equation for the velocity, along with two algebraic equations for the pressure and density, is only valid in the immediate vicinity of the shocks. However, Burgers' equation does retain the nonlinear character of the convective terms in the original momentum and energy equations, and the shock interaction phenomenon is a local one. Thus, the loss in quantitative information resulting from this approximation is offset by the gain in the understanding of shock-shock collisions, since Burgers' equation admits an analytic solution. This analytic solutions are obtained by means of a change of variable that replaces Burgers' equation with the linear heat conduction equation. 5 refs., 5 figs.

3727 **(UCRL—99682) Remapping on the staggered mesh.** Margolin, L.G.; Beason, C.W. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1988. Contract W-7405-ENG-48. 10p. (CONF-881093—9). NTIS, PC A02/MF A01. Order Number DE89002656/JAW.

From Nuclear explosives code developer's conference; Boulder, CO, USA (11 Oct 1988).

The staggered mesh of von Neumann and Richtmyer provides a natural pattern of data storage for Lagrangian fluid dynamics. However, the solution of the advection equation, a necessary step for continuous rezone codes, leads to problems for fields stored on the nodes of the mesh, and in particular for the material velocities. In this paper, we describe a new scheme for advecting nodal quantities that is exactly conservative, computationally efficient and consistent in the sense of truncation error with the advection of cell-centered quantities. 5 refs.

3728 **(UCRL—99731) DPDC [double-pass donor cell]: A second-order monotone scheme for advection.** Beason, C.W.; Margolin, L.G. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1988. Contract W-7405-ENG-48. 14p. (CONF-881093—7). NTIS, PC A03/MF A01. Order Number DE89002658/JAW.

From Nuclear explosives code developer's conference; Boulder, CO, USA (11 Oct 1988).

We are developing a new, second-order, monotone scheme for advection. DPDC (i.e., double-pass donor cell) is based on Smolarkiewicz' simple, positive definite method. Both schemes are multipass methods in which upstream approximations to the truncation error are subtracted from the equations. We describe two significant improvements to Smolarkiewicz' method. First, we use a local gauge transformation to convert the method from being positive definite to the stronger condition of being monotone. Second, we analytically approximate the sum of the corrections of all the passes to use in a single corrective pass. This increases the accuracy of the method, but does not increase the order of accuracy. We compare DPDC with van Leer's method for advection of several different pulses in a constant velocity field. 5 refs., 4 figs.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 3362

3729 **(DOE/ER/40272—63) Research in elementary particle physics at the University of Florida: Annual progress report.** (Florida Univ., Gainesville (USA)). 1 Nov 1988. Contract FG05-86ER40272. 209p. (UFTP—88-15). NTIS, PC A10. Order Number DE89002999/JAW.

This is a progress report on the Elementary Particle Physics program at the University of Florida. The program has five tasks covering a broad range of topics in theoretical and experimental high energy physics: Theoretical Elementary Particle Physics, Experimental High Energy Physics, Axion Search, Detector Development, and Computer Requisition.

3730 **(IC—88/109) Astroparticle physics (1988).** Salam, A. (International Centre for Theoretical Physics, Trieste (Italy)). 1988. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704699/JAW.

A review of the present situation in particle physics, astrophysics and cosmology is attempted, which emphasises the unity of the subject. (author). 1 fig., 8 tabs.

3731 **(LA-UR—88-3612) SABRINA - An interactive geometry modeler for MCNP [Monte Carlo Neutron Photon].** West, J.T.; Murphy, J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-881011—28). NTIS, PC A02/MF A01. Order Number DE89002293/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

SABRINA is an interactive three-dimensional geometry modeler developed to produce complicated models for the Los Alamos Monte Carlo Neutron Photon program MCNP. SABRINA produces line drawings and color-shaded drawings for a wide variety of interactive graphics terminals. It is used as a geometry preprocessor in model development and as a Monte Carlo particle-track postprocessor in the visualization of complicated particle transport problem. SABRINA is written in Fortran 77 and is based on the Los Alamos Common Graphics System, CGS. 5 refs., 2 figs.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 3363, 3364, 3440, 3441, 3442, 3443, 3444, 3445, 3446, 3447, 3448, 3449, 3450, 3848

3732 **(CONF-881151—25) Electromagnetic pair production in relativistic heavy-ion collisions.** Bottcher, C.; Strayer, M.R. (Oak Ridge National Lab., TN (USA)). 4 Oct 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01. Order Number DE89002224/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

We survey the production of electron, muon and tauon pairs in collisions between nuclei at ultra-relativistic energies. Such studies enhance our understanding of the role of the vacuum in field theory, and provide essential input for several experimental programs. A variety of models for the nuclear and nucleon form factors have been considered, revealing some degree of sensitivity to assumptions about sub-nuclear structure. We predict that the cross sections, even at high invariant masses and transverse momenta, are large on hadronic scales, and should act as useful probes of nuclear and nucleon form factors. 21 refs., 5 figs.

3733 **(DOE/ER/40325—11) Experimental studies of elementary particle interactions at high energies: Technical progress report.** Goulianos, K. (Rockefeller Univ., New York (USA)). 20 Sep 1988. Contract AC02-87ER40325. 17p. (RU—88/E-22). NTIS, PC A03/MF A01. Order Number DE89002714/JAW.

During the past year, our research effort at CERN focused on Experiment UA6, which is the study of {bar p}p and pp interactions at $\sqrt{s}$ = 24.3 GeV using a hydrogen gas jet target at the SPS Collider. In addition, a small fraction of our time was spent in completing analysis of ISR Experiment R110 and in the APE Computer project. These topics are discussed.

3734 **(ITEF—13(1988)) Cumulative K/sup +/-meson production by 10 GeV protons.** Boyarinov, S.V.; Gerzon, S.A.; Evseev, I.I. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 13p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704808/JAW.

Invariant of cross section of cumulative K/sup +/-meson production on beryllium, aluminium, copper, tantalum nuclei in the pA->K/sup +/x reaction are measured. More close f/sub k//sup +/(x)(f/sub π+/(x) relation (where x is the scale invariant variable) in comparison with pp-collisions is observed. 15 refs.; 5 figs.

3735 **(JINR-E—1-87-829) Search for and study of the asymptotic properties of highly excited nuclear matter.** Didenko, L.A.; Grishin, V.G.; Kuznetsov, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704838/JAW.

Submitted to 18 International Symp. on Multiparticle Dynamics, Tashkent, 1987.

In the invariant method of analysing multiple production, these processes are considered in a space the points of which are the 4-velocities u/sub i/=P/sub i//m/sub i/ where P/sub i/ are the 4-momenta and m/sub i/ the masses of particles, and b/sub ik/=-(u/sub i/-u/sub k/)/sup 2/=2((u/sub i/xu/sub k/)-1) are basic variables. General asymptotic properties of the cross sections of hadronic and nuclear processes at b/sub ik/ -> ∞ have been formulated as relativistic invariant approach. The most important of these regularities, the automodelity principle (substantially generalizing scale invariance) and the correlation attenuation principle, have been experimentally substantiated. According to the automodelity and correlation attenuation principles, the existence of two asymptotic b/sub ik/ regions has been established experimentally. These region are characterized by different properties of highly-excited nuclear matter (nucleon and hadron). It has been found that baryon clusters are mostly produced in the first region (0.01 << b/sub ik/ << 1) and hadron jets in the second one (b/sub ik/ >> 1). 7 refs.; 14 figs.

3736 **(JINR-R—1-88-51) Diffractive dissociation of neutrons in Λ/sup 0/K/sup 0/ on hydrogen at about 40 GeV energy.** Aleev, A.N.; Aref'ev, V.A.; Balandin, V.P. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704859/JAW.

Diffractive dissociation process np -> Λ/sup 0/K/sup p/ at 40 GeV neutron average energy has been studied in an experiment at Serpukhov accelerator. Both the diffraction cone slope, parameter B=/10+-2.5/ (GeV/c)/sup -2/ and cross section of the given dissociation channel σ=/5.3+-2.5/ μb have been measured. The results obtained are compared with the results of diffractive dissociation investigation of reaction pp -> Λ/sup 0/K/sup +/p at the same and higher energies. 16 refs.; 8 figs.

3737 **(RAL—88-056) Measurement of the spin-rotation parameter, β, in the reaction π/sup +/p -> K/sup +/Σ/sup +/ at 1.69 and 1.88 GeV/c.** Candlin, D.J.; Lowe, D.C.; Peach, K.J. and others. (Edinburgh Univ. (UK). Dept. of Physics). (Rutherford Appleton Lab., Chilton (UK)). Jun 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754774/JAW.

Values of the spin rotation parameter, β, are measured in the reaction π/sup +/p -> K/sup +/Σ/sup +/ at incident pion momenta of 1.69 and 1.88 GeV/c.

3738 **(SLAC-PUB—4675) Electron-positron collision physics: 1 MeV to 2 TeV.** Perl, M.L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jul 1988. Contract AC03-76SF00515. 11p. (CONF-8805142—44). NTIS, PC A03/MF A01. Order Number DE89002068/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

An overview of electron-positron collision physics is presented. It begins at 1 MeV, the energy region of positronium formation, and extends to 2 TeV, the energy region which requires an electron- positron linear collider. In addition, the concept of searching for a lepton-specific forces is discussed. 18 refs., 15 figs., 1 tab.

3739 **(SLAC-PUB—4742) Application of new technique for identifying exotic events with low visible energy in e^+e^- annihilation at 29 GeV.** Riles, K. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 4p. (CONF-8808145—3). NTIS, PC A02/MF A01. Order Number DE89002399/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Using a new technique based on photon tagging, we have searched for a fourth-generation charged lepton associated with a heavy neutral partner of nearly equal mass. Preliminary limits on allowed lepton masses are presented. 8 refs., 1 fig.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 3768, 3781, 3837, 3850

3740 **(BNL—41936) The search for scalar mesons.** Pennington, M.R. (Brookhaven National Lab., Upton, NY (USA)). Sep 1988. Contract AC02-76CH00016. 24p. (CONF-880862—2). NTIS, PC A03/MF A01. Order Number DE89002937/JAW.

From BNL workshop on glueballs, hybrids and exotic hadrons; Upton, NY, USA (28 Aug 1988).

The search of I = 0 0^{++} mesons is described. We highlight the crucial role played by the states in the 1 GeV region. An analysis program that with unimpeachable data would produce definitive results on these is outlined and shown with present data to provide prima facie evidence for dynamics beyond that of the quark model. We briefly speculate on the current status of the lowest mass scalar mesons and discuss how experiment can resolve the unanswered issues. 30 refs., 6 figs., 1 tab.

3741 **(CERN—88-06(v.1)) Polarization at LEP. Vol. 1.** Alexander, G.; Altarelli, G.; Blondel, A.; Coignet, G.; Keil, E.; Plane, D.E.; Treille, D. (eds.). (European Organization for Nuclear Research, Geneva (Switzerland)). 1 Sep 1988. 358p. NTIS (US Sales Only), PC A16/MF A01 - OSTI. Order Number DE88704897/JAW.

This report contains a collection of papers covering the most important part of studies carried out by five study groups in view of a programme of experiments with polarized beams at LEP, the Large Electron-Positron collider under construction at CERN. The emphasis is on precision measurements at the Z peak. Such measurements are shown to be of considerable theoretical interest as well as very clean from the point of view of theoretical and experimental uncertainties. The measurement of the beam polarization can certainly be performed with sufficient accuracy, thanks to the availability of both e/sup +/ and e/sup -/ beam polarization. The normalization of the data taken with different beam helicities poses certain constraints that are described. Substantial progress has been made in understanding the possibility of providing longitudinally polarized beams in the LEP machine: The design of new wigglers and spin rotators, the study of correction procedures and results of numerical simulations are presented.

3742 **(CERN—88-06(v.2)) Polarization at LEP. Vol. 2.** Alexander, G.; Altarelli, G.; Blondel, A.; Coignet, G.; Keil, E.; Plane, D.E.; Treille, D. (eds.). (European Organization for Nuclear Research, Geneva (Switzerland)). 1 Sep 1988. 267p. NTIS (US Sales Only), PC A12/MF A01 - OSTI. Order Number DE88704898/JAW.

This report contains a collection of papers covering the most important part of studies carried out by five study groups in view of a programme of experiments with polarized beams at LEP, the Large Electron-Positron collider under construction at CERN. The emphasis is on precision measurements at the Z peak. Such measurements are shown to be of considerable theoretical interest as well as very clean from the point of view of theoretical and experimental uncertainties. The measurement of the beam polarization can certainly be performed with sufficient accuracy, thanks to the availability of both e/sup +/ and e/sup -/ beam polarization. The normalization of the data taken with different beam helicities poses certain constraints that are described. Substantial progress has been made in understanding the possibility of providing longitudinally polarized beams in the LEP machine: The design of new wigglers and spin rotators, the study of correction procedures and results of numerical simulations are presented.

3743 **(EFI—967(17)-87) Relativistic effects in the quarkonia radiative decays with axion production.** Aznauryan, I.G.; Grigoryan, S.G.; Matinyan, S.G. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704682/JAW.

It is shown that relativistic effects lead to a strong decrease in the values of ratios Br(psi->aγ)/Br(psi->μ/sup +/μ/sup -/) and Br(γ->aγ)(Br(γ -> μ/sup +/μ/sup -/), predicted by the nonrelativistic quark model. This does not already allow to unambiguously exclude, on the basis of available experimental data on these decays, the existence of a long-lived axion. 23 refs.

3744 **(IC—88/144) Non-standard weak bosons at e-p collider.** Kneur, J.L.; Larbi, S.; Narison, S. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 32p. (PM—88/29). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704703/JAW.

We compare the effects of non-standard weak bosons (NSB) expected from E/sub 6/-Superstrings (Z'), strong Higgs (V/sub 0/) and composite (spin 0,1,2) models by using the classical inclusive e/sup +-/p -> e/sup +-/ + "Hadrons" processes at HERA energies. By assuming a 30% uncertainty for the measurement of the differential cross-sections for unpolarized e/sup +-/ beams and a deviation chemical bondΔAchemical bond=0.1 from the longitudinal asymmetry of the Standard Model (SM), we derive significant bounds on the masses of composite NSB with the exception of the excited Z*. The V/sub 0/ of the strong Higgs model is unobservable. Useful bounds on the Z' of the E/sub 6/ and the Z* can only be obtained by increasing the precision measurements (chemical bondΔAchemical bond≦0.05) of the longitudinal asymmetry. Therefore, we give bounds on these NSB for chemical bondΔAchemical bond=0.02 after selecting the combination of longitudinal asymmetries where their effects are optimal. (authro). 14 refs, 7 figs, 5 tabs.

3745 **(IC—88/157) Relativistic B-S wave function of the spin-0-spin-3/2 bound state and its applications.** Song Xiaotong; Dai Youshan. (International Centre for Theoretical Physics, Trieste (Italy); Hangzhou Univ., ZJ (China)). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704713/JAW.

In this paper, we derive the Bethe-Salpeter equation for electromagnetic bound system consisting of the particles with spin-0 and spin-3/2, and solve it in the ladder approximation. The Bethe-Salpeter wave function is given with accuracy up to the order of α. Using this wave function the probability for producing the (pi+, omega-) atom in Ω/sup -/p reaction is calculated. The disintegration cross section and decay rate are also calculated. (author). 19 refs, 3 figs.

3746 **(IFVE-OTF—87-194) Spectrum of heavy hadrons in QCD with color scalars.** Korol'kov, A.I.; Matveev, V.A. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704774/JAW.

A model of quantum chromodynamics with light colored scalars in the arbitrary representation of the gauge group SU/sub c/(3) is discussed. Effective scales and limits of the perturbation theory application for e/sup +/e/sup -/ annihilation into hadron in the channels of the quark-antiquark and scalar pair production have been defined. The value of gauge invariant condensate for scalar fields have been found by the order of magnitude from the known value of the quark condensate. On the basis of finite energy QCD sum rules analysis it was concluded that the mass scale and other parameters of new hadrons containing scalars depend on the type of representation according to which the color scalars are transformed. 12 refs.; 1 tab.

3747 **(IFVE-OTF—88-34) Stationary solution of equation of simple production and quadrupole death of gluons.** Batunin, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704775/JAW.

Submitted to the journal JETP Lett. .

An account of the gluon confluence in a cascade is shown to result in the transition from the negative binomial multiplicity distribution to Poisson one at high energies. 4 refs.

3748 **(INIS-mf—11841) Soliton models of the hadrons.** Forkel, H. (Regensburg Univ. (Germany, F.R.). Naturwissenschaftliche Fakultaet 2 - Physik). 1987. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755580/JAW.

The object of this thesis is the study of two hadron models. Their common characteristics are a two-phase structure suggested by QCD with explicite quark core and the modelling of non-perturbative vacuum properties by meson-field soliton configurations. In the generalized Lee-Friedberg model the non-topological statical soliton solution characterizes correlations of the vacuum and generates by means of nonlinear coupling to the quark absolute confinement. For the stability analysis of these localized solutions a qualitative dependence of energy and fermion number is derived which implies the existence of absolutely stable soliton configurations. First studies of fermion vacuum fluctuations in related models exhibit an essential influence of virtual quarks on structure and dynamics of the solitons. In order to get insight into the leading fermion-loop effects in the Lee-Friedberg model after separation of the valence-quark contributions from the fermion functional integral a proper-time expansion of the heat kernel of the remaining effective action was performed. The main characteristic of the chiral

hybrid bag model developed in the second part of the thesis is the modelling of quark vacuum properties in the topological bag by means of a phenomenological antisoliton field. The deviations of the nucleon observables calculated by means of this model from the experimental data lie in the range typical for this class of models. (orig./HSI).

3749 **(ITEP—19(1988)) Upper limit to neutrino magnetic moment from the statistics of white dwarfs.** Blinnikov, S.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704822/JAW.

Comparing the theoretical lifetimes of white dwarfs with recent observational data it is found that the neutrino magnetic moment is certainly below 10/sup -11/ Bohr magnetons. 13 refs.; 1 fig.

3750 **(ITEP—44(1987)) Neutrino decay in matter.** Berezhiani, Z.G.; Vysotskij, M.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704823/JAW.

It is demonstrated that the matter can induce a decay of neutrino into antineutrino and light scalar particle (majoron): $\nu \rightarrow \nu$-tilde$+\alpha$, or vice versa, ν-tilde $\rightarrow \nu+\alpha$. The diagonal as well as non-diagonal transitions on neutrino types are possible. The decay probabilities depend on neutrino energies in an unusual way. Applications for accelerator neutrinos passing through the earth, solar neutrinos, neutrino emission accompanied the gravitational collapse of stellar core are discussed. 8 refs.

3751 **(ITEP—49(1988)) Structure functions of lepton-nucleon deep inelastic scattering in QCD. 2. Transverse momentum distribution of valence quarks.** Belyaev, V.M.; Ioffe, B.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704824/JAW.

Basing on the method suggested earlier transverse momentum distributions of valence quarks in proton in the region of small transverse momenta K/sub tr/ and intermediate x are calculated. It is found that distributions in K/sub tr//sup 2/ are rather narrow: characteristic values of $<$K/sub tr//sup 2/$>$ are 0.1-0.2 GeV/sup 2/. 3 refs.; 5 figs.

3752 **(JINR-E—2-87-663) Electromagnetic α/sup 3/ contributions to e/sup +/e/sup -/ - annihilation into fermions in the electroweak theory. Total cross section σ /sub T/ and integrated asymmetry A/sub FB/.** Bardin, D.Yu.; Riemann, T.; Fedorenko, O.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Petrozavodskij Gosudarstvennyj Univ. (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704839/JAW.

Analytic expressions are obtained for the completely integrated QEDα/sup 3/ contributions to the total cross section σ/sub T/ and the integrated forward-backward asymmetry A/sub FB/ in the process e/sup +/e/sup -/->f-barf(γ). The photons are assumed not to be observable. The calculation is performed in ultrarelativistic approximation over fermion masses, and the mass M/sub Z/ and width Γ/sub Z/ of the neutral intermediate vector boson are not treated as small parameters. 20 refs.; 1 fig.; 2 tabs.

3753 **(JINR-E—2-87-918) Lipatov's QCD pomeron and Sp-barpS data on the phase of p-barp elastic scattering.** Kopeliovich, B.Z.; Potashnikova, I.K.; Nikolaev, N.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; AN SSSR, Moscow. Inst. Teoreticheskoj Fiziki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704841/JAW.

Submitted to the journal Phys. Lett. .

An analysis of the cosmic ray data on σ/sub abs/(pAir) has lead to the conclusion that σ/sub tot/(pp) rises steeply beyond $\sqrt{s}$=1 TeV, which nicely agrees with Predictions of Lipatov's QCD pomeron. A large, positive, phase of the forward p-barp scattering amplitude implied by this rapid rise of σ/sub tot/(pp), is shown to fit perfectly recent Sp-barpS data on σ/sub pb/ar/sub p/ =ReF/sub pb/ar/sub p/(t=O)/ImF/sub pb/ar/sub p/(t=O). predictions for σ/sub tot/(p-barp/sub a/nd rho/sub p-barp/ at Tevatron, $\sqrt{s}$=1.6 TeV, are presented: σ/sub tot/(p-barp)=80-90 mb, rho/sub p-barp/ $\sim$ 0.2. 13 refs.; 4 figs.; 1 tab.

3754 **(JINR-E—2-88-78) Phenomenology of chromostatics.** Pervushin, V.N.; Kallies, W.; Nguyen Suan Han; Sarikov, N.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Moskovskij Gosudarstvennyj Univ. (USSR); AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704845/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

For the description of hadrons as bound states the physica perturbation theory (PPT) on the spatial components of the gluor field over the exact solution, defined by the temporal one, is pro posed. A quntization method is used, which in each order of the PPT is relativistic-covariant, and an elimination of the infrared di vergences with the help of the phenomenological redefinition of the Coulomb potential. The main elements of the PPT: the Green functions of quarks and gluons, the effective coupling constant are found; and the functional, unifying the meson spectroscopy, dua amplitudes and chiral Lagrangians, is constructed. 12 refs.; 1 fig.

3755 (LBL—24604, pp 251-255) **Charm production in ultra-relativistic heavy ion colliders.** Matsui, T. (Massachusetts Institute of Technology, Cambridge (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—). Contract AC02-76ER03069.

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

There are several reasons why it is important to measure the charm production cross section in ultrarelativistic heavy ion collisions. (1) Charm carries an information of the very early stage of the collision process: since the charm quark is so massive (m/sub c/ = 1.5-1.8 GeV), it is likely that its creation takes place only at the very beginning of the whole collision process and the charm quark abundance will be essentially frozen in the later stage of the matter evolution. Hence it can be used to probe the early stage of matter formation and to test dynamical models of particle production. (2) If there is a strong enhancement of charm production in heavy ion collisions, in comparison with non-charm particle production, it would spoil some interesting signals of the plasma formation: J/psi suppression by the plasma screening effect will be compensated by the enhanced recombination of c anti c into the J/psi during the hadronization stage: semileptonic decay of charmed mesons produces a large background for the dilepton signals from the plasma. In this short report, the author first makes a crude and rather conservative estimate of the expected charm abundance in nucleus-nucleus collisions based on the measured charm production cross section in pp interactions, and then discusses a possible coherent soft process which would lead to a further enhancement of the char production in the case of heavy ion collisions. 10 references.

3756 (LBL—-24604, pp 256-278) **Charm production and the dilepton background from decay of charmed hadrons in ^{197}Au + ^{197}Au collisions at 200 GeV/A.** Shor, A. (Brookhaven National Lab., Upton, NY (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

A calculation is performed to determine the level of charm production and the background to the dilepton mass distribution from the semi-leptonic decay of charmed hadrons for ^{197}Au + ^{197}Au collisions at 200 GeV/A. The calculation incorporates

HIJET for the systematics of nucleus-nucleus collisions, ISAJET for computing the cross section and hadron spectra for charm production, and a Monte-Carlo code which combines these results and generates lepton pairs from the decay of charmed hadrons. A mean multiplicity of 3.3 charmed hadrons is found for a central gold on gold collision. This brings about an appreciable level of background for lepton pairs above a mass of about 2 GeV. The dilepton background from charm decay can be significantly reduced with appropriate cuts on the polarization angle of the lepton pairs. 14 references, 15 figures.

3757 (LBL—24604, pp 279-293) **Pulsed electromagnetic production of leptons.** Bottcher, C.; Strayer, M.R. (Oak Ridge National Lab., TN (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—). Contract AC05-84OR21400.

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

It seems likely that significant heavy lepton production and emission will occur from the electromagnetic fields which arise in relativistic heavy-ion collisions. This possibility was first suggested several years ago by Gould, based on estimates using the Weizsaecker-Williams method. The technique can be derived from perturbation theory, as discussed by Soff in the context of electron pair production in relativistic collisions of uranium. In such collisions, the near-zone electromagnetic field becomes very large, transverse, and very sharply pulsed. In their studies, which are nonperturbative, the authors find large cross sections from this mechanism, much larger than from the Drell-Yan mechanism, which has been suggested as a possible means of diagnosing the transition from hadronic matter to a quark-gluon plasma in such collisions. Positron production in slow, heavy-ion collisions has been the subject of intense experimental and theoretical investigation for over a decade. Preliminary investigations using nonperturbative techniques have extended the theory to relativistic energies and necessitate the accurate calculation of all of the particle-antiparticle states which are excited out of the vacuum in the presence of the strong transient fields. For each state, the time-dependent Dirac equation must be solved in three space dimensions, which is very difficult and expensive. In this paper, the authors address the production of lepton pairs out of the vacuum using these methods and a local field model. The formal details of this are given elsewhere. In their current work, they shall apply the model and discuss in detail the production cross sections as a function of the transverse momentum, the invariant mass, and the rapidity. 11 references, 7 figures.

3758 (LBL—24604, pp 294-301) **Event generator for ultrarelativistic proton-proton collisions: a multistring model.** Werner, K. (Brookhaven National Lab., Upton, NY (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—). Contract AC02-76CH00016.

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

The author presents a multistring model for low pt proton proton collisions. The process is divided into two independent steps: formation of color strings and subsequent fragmentation of strings. He takes into account diffractive and nondiffractive contributions, each contribution consisting with a certain probability w/ sub i/ of 2i strings. The i > 1 contributions correspond to multi-Pomeron exchange. 18 references, 5 figures.

3759 (LBL—24604, pp 302-306) **Simple model for heavy ion collisions.** Boeggild, H. (Niels Bohr Institute (Denmark)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

In this note the author describes briefly a simple model for heavy ion collisions developed by A.D. Jackson and himself, based on an approach by G. Baym et al. The model is essentially geometrical describing the collision between two nuclei as the interaction between two extended objects (consisting of protons and neutrons), having the impact parameter as the main parameter. At a given value of b the calculation of the overlap of the two colliding objects leads to a certain expected mean number of independent nucleon-nucleon interactions each producing a certain multiplicity, E/ sub T/ etc. The actual number of collisions is assumed to be Poisson distributed around the mean. The nucleon-nucleon collision physics is assumed to be known and is essentially treated as a black box. 4 references, 4 figures.

3760 (LBL—24604, pp 307-317) **Nuclear stopping and energy deposition into the central rapidity region.** Zingman, J.A. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—). Contract W-7405-ENG-48.

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Nuclear stopping and energy deposition into the central rapidity region of ultrarelativistic heavy-ion collisions are studied through the application of a model incorporating hydrodynamic baryon flow coupled to a self-consistent field calculated in the flux tube model. Ultrarelativistic heavy ion collisions are modeled in which the nuclei have passed through each other and as a result are charged and heated. 9 references, 3 figures.

3761 (LBL—24604, pp 318-334) **Beyond the production of the quark-gluon plasma.** Boguta, J. (Advanced Nuclear Concepts, San Francisco, CA (USA)). Jan 1988. NTIS, PC A15/MF A01. Order Number DE88008389/JAW. (CONF-870543—).

From 2. workshop on experiments and detectors for relativistic heavy ion collider (RHIC); Berkeley, CA, USA (25 May 1987).

Quark-gluon plasma is a highly unstable state of matter. In the hadronization process all energetically available nuclear structures should be produced. The plasma can be a gateway to new nuclear structures. Three exotic excitations, HENS, HADRODS and STRINGS are discusses from relativistic nuclear field theory point of view. 17 references, 8 figures.

3762 (LUNFD6/TFME—1013-1-14) **Phenomenological studies of hadronic collisions.** van Zijl, M. (Lund Univ. (Sweden). Dept. of Theoretical Physics). Apr 1987. 95p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755128/JAW.

Several aspects of hadronic collisions are studied in a phenomenological framework. A Monte Carlo model for initial state parton showers, using a backwards evolution scheme, is presented. Comparisons with experimental data and analytical calculations are made. The consequence of using different fragmentation model on the determination of α_s is also investigated. It is found that the different fragmentation models lead to the reconstruction of significantly α_s values. Finally the possibility of having several independent parton-parton interactions in a hadron-hadron collision is studied. A model is developed, which takes into account the effects of variable impact parameters. This is implemented in a Monte Carlo computer program and extensive comparisons with experimental data are carried out. There is clear evidence in favour of multiple interactions with variable impact parameters.

3763 (RAL—88-041) **Inclusive J/psi production and measurement of the low-x gluon distribution of the proton.** Tkaczyk, S.M.; Saxon, D.H.; Stirling, W.J. (Durham Univ. (UK). Dept. of Physics). (Rutherford Appleton Lab., Chilton (UK)). May 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754772/JAW.

We consider the inelastic photoproduction of J/psi, via the subprocess $\gamma g \rightarrow (J/\psi) g$ and use explicit formulae for the cross section for electroproduction at HERA energies to provide a direct determination of the gluon distribution G(x) at x values in the range $6.0 \cdot 10^{-4}$ to $1.4 \cdot 10^{-3}$. Assuming an integrated luminosity of 100pb^{-1}, we conclude that it should be possible to distinguish between different theoretical predictions of the gluon structure function of the proton at low x.

3764 **(RAL—88-061) Yang-Mills formulation of interacting strings.** Chan Hongmo; Tsou Sheungtsun. (Rutherford Appleton Lab., Chilton (UK); Oxford Univ. (UK). Mathematical Inst.). (Rutherford Appleton Lab., Chilton (UK)). Jun 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755487/JAW.

A suggestion that the theory of interacting open bosonic string be reformulated as a generalised Yang-Mills theory is further elucidated. Moreover, a serious reservation regarding the ordering of operators in the earlier 'proof' of equivalence between the new and standard formulations is now removed.

3765 **(USIP—87-14) Theory of quark mixing matrix and invariant functions of mass matrices.** Jarlskog, C. (Stockholm Univ. (Sweden). Inst. of Physics). Oct 1987. 23p. (CONF-8709147—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755149/JAW.

From International symposium on the production and decay of heavy flavors; Stanford, CA, USA (1 Sep 1987).

The outline of this talk is as follows: The origin of the quark mixing matrix. Super elementary theory of flavour projection operators. Equivalences and invariances. The commutator formalism and CP violation. CP conditions for any number of families. The 'angle' between the quark mass matrices. Application to Fritzsch and Stech matrices. References.

3766 **(UWThPh—1987-31) Radiative kaon decays and cp violation in chiral perturbation theory.** Ecker, G.; Pich, A.; Rafael, E. de. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik; European Organization for Nuclear Research, Geneva (Switzerland); Boston Univ., MA (USA). Dept. of Physics). (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1987. 43p. (CERN-TH—4853/87). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704896/JAW.

Chiral perturbation theory is a very useful framework for testing the Standard Model in processes where long-distance effects are expected to play an essential role. We analyze the rare K decays K/sup 0/-> γl/sup +/l/sup -/, K/sup +/->π/sup +/γγ and K/sub L/->π/sup 0/l/sup +/l/sup -/ in the effective chiral formulation of the Standard Model. These processes, like the decays K/sup 0/->γγ, K/sup +/->π/sup +/l/sup +/l/sup -/, K/sub S/->π/sup 0/l/sup +/l/sup -/ and K/sup 0/->π/sup 0/γγ discussed in previous work, have the property that the corresponding amplitudes vanish to lowest order in chiral perturbation theory. Precise predictions for decay rates and spectra are made in terms of a few coupling constants not restricted by softly broken chiral symmetry alone. Special consideration is given to various possible tests of CP non-invariance in these decays, in particular to effects due to intrinsic CP violating observables such as the charge asymmetries in K/sup +-/-> π/sup +-/γγ and K/sup +-/-> π/sup +-/l/sup +/l/sup -/, the one-photon exchange contribution to K/sub L/->π/sup 0/e/sup +/e/sup -/ and the transverse polarization in K/sub L/-> π/sup 0/μ/sup +/μ/sup -/. Detailed numerical results are shown. 32 refs., 11 figs.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 3951, 3958

3767 **(IC—88/148) On the hyperKaehler potential and the selection rule of the hyperKaehler geometry.** Saidi, E.H. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704707/JAW.

We build a new class of D=4, N=2 supersymmetric nonlinear σ-model completely specified by a neutral hyperKaehler potential. The corresponding hyperKaehler metric is obtained and its hyperKaehler symmetries are discussed. The fundamental hyperKaehler form is derived and its properties are established. Finally, a selection rule of hyperKaehler manifolds from the Kaehler ones is obtained. (author). 17 refs.

6454 Field Theory

REFER ALSO TO CITATION(S) 3948

3768 **(BONN-TK—86-07) Study of the structure of a gauge field theory by many-body theoretical methods.** Nguyen Quang, H. (Bonn Univ. (Germany, F.R.). Inst. fuer Theoretische Kernphysik; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Jul 1986. 116p. (In German). Bonn Univ. (Germany, F.R.). Inst. fuer Theoretische Kernphysik.

The author describes an attempt to calculate the spectrum of a pure SU(N) Yang-Mills theory by means of a description of the field-theoretical Hamiltonian as a many-body operator in the Fock space. After a construction of the vacuum by means of two- and three-body clusters of gluons he shows that this vacuum can be defined as quasiparticle vacuum. By means of this vacuum a formalism is derived which is equivalent to the Tamm-Dancoff approximation in nuclear physics. Using this formalism glueballs are calculated as two-quasiparticle states. (HSI).

3769 **(DOE/ER/40325—10) [Experimental studies of elementary particle interactions at high energies]: Technical Progress Report, October 1, 1987--September 30, 1988.** Beg, M.A.B.; Dolan, L.A. (Rockefeller Univ., New York (USA)). 1988. Contract AC02-87ER40325. 15p. NTIS, PC A03/MF A01. Order Number DE89002719/JAW.

The bulk of our work is in the major areas of strength with which our group is identified: symmetry breaking in unified gauge theories of strong, electromagnetic and weak interactions, especially the scalar sector of the canonical theory, related supercomputer-aided studies of local quantum field theory, unification inclusive of gravity, infinite dimensional algebras and superstring theory. We have made contributions to cosmology and phenomenology as well. A detailed account is contained in this paper.

3770 **(IC—88/90) Quantum theory of cosmological perturbations.** Mukhanov, V.F. (International Centre for Theoretical Physics, Trieste (Italy)). May 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704696/JAW.

The metric perturbations of scalar type in the isotropic Universe filled by a scalar field are considered. The action for such perturbations in terms of gauge invariant variables is obtained and a self-consistent quantum theory is constructed. The inhomogeneities spectrum in the inflationary Universe is calculated. (author). 18 refs, 1 fig.

3771 **(IC—88/94) Massive and massless gauge fields of any spin and symmetry.** Hussain, F.; Thompson, G.; Jarvis, P.D. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik; International Centre for Theoretical Physics, Trieste (Italy); Tasmania Univ., Hobart (Australia). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). May 1988. 12p. (MZ-TH—88/10). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704697/JAW.

An analysis of the BRST approach to massive and massless gauge fields of any spin and symmetry is presented. Previous results on massless gauge fields are extended to totally antisymmetric massless tensors and Kaehler-Dirac particles. Two methods for arriving at a BRST invariant, massive theory from the corresponding massless one are discussed. The first allows for an interpretation in terms of dimensional reduction, while the second keeps the BRST operator of the massless theory, but employs gauge invariant fields. (author). 10 refs.

3772 **(IC—88/158) Derivation of envelope (de Broglie) solitons for non-linear Klein-Gordon equation by Hirota's method.** Baby, B.V.; Barut, A.O. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704714/JAW.

A new envelope soliton-like solution of the non-linear equations of motion of the λphi/sup 4/-Lagrangian field theory is derived, using Hirota's bilinear operator method. (author). 7 refs.

3773 **(IC—88/169) Vanishing of the vacuum amplitude of heterotic string compactified on a tensor product of N=2 superconformal models.** Kei Ito. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704721/JAW.

The vacuum amplitude of heterotic string compactified on a tensor product of nine copies of c=1, N=2 superconformal models is shown to vanish due to a generalized Riemann's theta identity associated with the 12x12 matrix identity /sup t/BB=6/sup 2/I/sub 12/, identity B/sub ij/=-5(i=j), 1(inot =j). (author). 4 refs.

3774 **(IC—88/173) BRST cohomology operators on string superforms.** Dao Vong Duc; Nguyen Thi Hong. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704723/JAW.

BRST cohomology calculus in the space of superstring differential forms is treated in detail. The explicit expressions of cohomology operators are derived for superforms of arbitrary order. Various identities for the structure constants of the associated superalgebras are also given. (author). 16 refs.

3775 **(IC—88/217) Complex structures on the coadjoint orbit spaces of Diff(S/sup 1/) and on Bers' universal Teichmueller space are compatible.** Nag, S.; Verjovsky, A. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704742/JAW.

Precisely two coadjoint orbit spaces of the group of string reparametrizations carry in a natural way the structure of infinite dimensional, holomorphically homogeneous complex manifolds. These are M/sub 1/=Diff(S/sup 1/)/Rot(S/sup 1/) and M/sub 2/=Diff(S/sup 1/)/Mo-barb(S/sup 1/). M/sub 2/ can be naturally considered as (embedded in) the classical univeral Teichmueller space T(Δ), simply by noting that a diffeomorphism of S/sup 1/ is a quasi-symmetric homeomorphism. T(Δ) is itself a homomorphically homogeneous complex Banach manifold. We prove that the inclusion of M/sub 2/ in T(Δ) is complex analytic. Every Teichmueller space of finite or infinite dimension is contained canonically and holomorphically in T(Δ). Our result thus appears to connect the loop space approach to bosonic string theory with the sum-over moduli (Polyakov path integral) approach. (author). 12 refs.

3776 **(IC—88/248) Canonical measures on the moduli spaces of compact Riemann surfaces.** Nag, S. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704752/JAW.

We first study some explicit relations between the canonical line bundle and the Hodge bundle over moduli spaces for low genus. This leads to a natural measure on the moduli space of every genus which is related to the Siegel symplectic metric on Siegel upper half-space as well as to the Hodge metric on the Hodge bundle. (author). 9 refs.

3777 **(IC—88/250) Stability of the static solitons in a pure spinor theory with fractional power nonlinearities.** Akdeniz, K.G.; Tezgor, G.; Barut, A.O.; Kalayci, J.; Okan, S.E. (Trakya Univ., Edirne (Turkey). Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704754/JAW.

Soliton solutions are obtained in a pure fermionic model with fractional power nonlinear self-interactions. The stability properties of the minimum solutions have also been investigated within the framework of the Shatah-Strauss formalism. (author). 10 refs.

3778 **(IC—88/259) Kinks in systems with degenerate critical points.** Gonzales, J.A.; Estrada Sarlabous, J. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704760/JAW.

An analytic expression for the effective interaction force of a linked kink-antikink state in a general potential possessing two minima is obtained. It is also shown that for degenerate minima the interaction has a long range character. (author). 11 refs, 3 figs.

3779 **(IC—88/269) Odd time formulation of the Batalin-Vilkovisky method of quantization.** Dayi, O.F. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704762/JAW.

By using a Grassmann odd parameter which behaves like time, it is shown that the main features of the Batalin-Fradkin method of quantization of reducible gauge theories can be formulated systematically. (author). 6 refs.

3780 **(IFT-TM—03/87) Critical study of Weyl anomaly calculation in the string by Fujikawa method.** Dalmazi, D. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1987. 242p. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88704769/JAW.

The Fujikawa's evaluation of Weyl's anomaly in the bosonic string is carefully analyzed, paying special attention to the covariance under conformal transformation. The choice of operators used to calculate the variation of path integral measure under Weyl's transformation is discussed in detail.

3781 **(IFVE-ONF—87-180) Superphysics and prospects of its discovery at the UNK (accelerator-storage complex) proton collider.** Volkov, G.G.; Liparteliani, A.G.; Sokolov, A.A.; Kereselidze, A.R.; Tkebuchava, F.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; Tbilisskij Gosudarstvennyj Univ. (USSR)). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 104p. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704772/JAW.

Submitted to the EhChAYa.

The consistent stages of development of superphysics (models with global and local supersymmetry in close connection with geometrical ideas, concerning the picture of world at Planck distances) are expounded. The paper contains a detailed consideration of development and possibilities of supersymmetry in the solution of some problems of the Standard Model and Grand Unification Theories, as well as discussion of two other basic ingredients of modern 10-dimensional theories of superstring - the string theories and Kaluza-Klein approach. The ways of realistic contact of superstring theories with four-dimensional phenomenology are discussed. The low energy consequences of perstring theories, which may show up at UNK proton collider energies are given. The problem of supersymmetry breaking in superstring theories (closely connected with expected spectrum of superpartners) is considered. The possibilities of the UNK pp-collider ($\sqrt{s}$=6 TeV) with respect to investigation of production of superpartners, as well as new superstring inspired gauge bosons are analysed. 113 refs.; 12 figs.; 10 tabs.

3782 **(ITEP—51(1988)) Discrete symmetries in string theory.** Ol'shanetskij, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704825/JAW.

Examples of discrete symmetries and their applications to the first-quantized formulation of string thory are presented. The string considered here lives on the Calabi-Yau space (CYS). 19 refs.

3783 (JINR-E—2-88-68) New perturbative approach to QCD. Pervushin, V.N.; Kallies, W.; Nguyen Suan Han; Sarikov, N.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Moskovskij Gosudarstvennyj Univ. (USSR); AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Tneoretical Physics). 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704844/JAW.

Submitted to the journal Phys. Lett., B.

For the description of bound states in QED and QCD the physical perturbation theory on the spatial components of the vector over the exact solution, defined by the time one, is proposed. It is shown this perturbation theory in QCD can be redefined so that it reproduces the main elements of hadron physics: confinement, spectroscopy of light and heavy quarkonia, dual-resonance amplitudes, chiral Lagrangians and the parton model. 11 refs.; 1 fig.

3784 (JINR-R—2-87-913) On chiral fermion fields at high energies. Kadyshevskij, V.G.; Fursaev, D.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Moskovskij Gosudarstvennyj Univ. (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704861/JAW.

Submitted to the journal Dokl. Akad. Nauk SSSR.

Adequate expansion of the Dirac fields over chiral components is found in the field theory with "fundamental mass", a new universal parameter. In the high energy region E >or approx. M it differs essentially from the standard expansion psi=psi=L+psi/sub R/=1+y/sup 5//2psi+1-y/sup 5//2psi. The new concept of chiral fermion fields can be used in generalising the electroweak Salam-Weinberg-Glashow model along the lines of the fundamental mass theory. 15 refs.

3785 (JINR-R—2-88-21) Analysis of the Tamm problem on a charge radiation at its uniform motion on a finite trajectory. Zrelov, V.P.; Ruzhichka, Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 23p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704864/JAW.

Submitted to the journal Nucl. Instrum. Methods Phys. Res.

The main conclusions of the Tamm problem concerning the radiation caused by an electron moving uniformly and linearly in a transparent medium on finite part of its trajectory is analysed. Characteristics of this radiation are compared with a bremsstrahlung emerging at a charge instant acceleration, account taken of the dielectric properties of the medium. It is shown that the Tamm formula describes the resulting radiation emerging from the interference of two bremsstrahlung emitted at double identical and opposite changes of the particle velocity. It is also shown that such a mechanism may serve as another approach to the explanation of Vavilov-Cherenkov phenomenon. 6 refs,; 6 figs.; 4 tabs.

3786 (NBI-HE—88-01) Reggeons and the string path integral. Sidenius, J.R. (Niels Bohr Inst., Copenhagen (Denmark)). Jan 1988. 19p. (CONF-8710282—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755427/JAW.

From Conference on perspectives in string theory; Copenhagen, Denmark (12 Oct 1987).

The purpose of this talk is to show how to compute string amplitudes from the Polyakov path integral for external states given in terms of wave functions on the world sheet. (orig./HSI).

3787 (NBI-HE—88-32) Formulation using compactified dimensions to get an inequality relating coupling constants and the number of generations. Nielsen, H.B.; Bennett, D.L.; Picek, I. (Niels Bohr Inst., Copenhagen (Denmark); Danmarks Farmaceutiske Hoejskole, Copenhagen. Dept. of Physics; Institut Rudjer Boskovic, Zagreb (Yugoslavia)). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Institut Rudjer Boskovic, Zagreb (Yugoslavia)). May 1988. 23p. (CONF-871294—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755200/JAW.

From Workshop on superstring theory; Kanpur, India (13 Dec 1987).

It is phenomenologically observed that the magnitude of the gauge coupling constants is of the order of one divided by the square root of the number of generations, provided unit coupling strength is established as the mean field approximation (M.F.A.) value for the critical coupling at the transition between the confined and Coulomb phases. We construct a model that crudely realizes such a relation. The basic features are: 1) A gauge group with a direct product from GxGx...xG at the fundamental scale; 2) one factor G associated with each generation; 3) at the fundamental scale, confinement must be avoided if the emergence of low energy physics is not to be precluded a priori; therefore the coupling constants for all of the factor groups G must be weaker than a suitably defined critical vàlue; 4) in going to large distances, global gauge inveriance is maintained only for the diagonal subgroup of the direct product gauge group; 5) the effective inverse squared coupling constant corresponding to the reduced symmetry G/sub diag/ is the sum of the inverse squared coupling constants for each of the gauge group factors G at the fundamental scale. (orig./HSI).

65 PHYSICS II

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 3725, 3734, 3872, 3922

3788 (BNL—41723) Recent experiments in novel nuclear excitations at the BNL AGS. Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 23p. (CONF-880938—3). NTIS, PC A03/MF A01. Order Number DE89001087/JAW.

From International symposium on mesons and light nuclei; Rez, Czechoslovakia (5 Sep 1988).

Recent experimental work at the AGS dealing with unusual nuclear excitations is summarized. Three examples are given: the deexcitation of Λ hypernuclei by γ transitions, the production of Λ hypernuclei by the (π^+,K^+) reaction, and the search for {eta}-nuclear excitations. The status of each field and the implications of the research for nuclear theory are discussed. 11 refs., 10 figs., 1 tab.

3789 (ITEF—34(1988)) Disintegration of photoemulsion nuclei in 32 GeV/c muon inelastic scattering at small angles. Slow particle emission. Rabin, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 29p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704812/JAW.

Energy, angular and correlation characteristics of slow particles, ≦30 MeV/nucleon emitted in the reaction of 32 GeV/c muon inelastic scattering by photoemulsion heavy nuclei, A≅100, at small values of transfered four momentum square, Q/sup 2/≅0.1 (GeV/c)/sup 2/, are analyzed. Arguments for formation of multiparticle moving excited cluster in muon events are presented: explanation of observed characteristics of slow particles in the framework of statistic theory is possible if it is assumed that cluster forms initially in the reaction, and then formation of moving excited nucleus - the main source of slow particles - takes place during cluster interaction with nucleus-target. Possibility of formation of other preequilibrium sources of slow particles is mentioned. 12 refs.; 8 figs.

3790 (ZfK—584, pp 15-16) **Application of K/sup +/- interferometry for the investigation of the early stage in heavy ion collisions at relativistic energies.** Gersch, H.U. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3791 (ZfK—584, pp 13) **Phenomenology of angular distributions of 14-MeV-neutron-inelastic scattering: comparison of experimental and theoretical results.** Hermsdorf, D.; Kalka, H.; Steiniger, U. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3792 **(ZFK—584) Annual report 1985 on nuclear physics activities and applications.** (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Karl-Marx-Universitaet, Leipzig (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Friedrich-Schiller-Universitaet, Jena (German Democratic Republic); Bergakademie Freiberg (German Democratic Republic)). Apr 1986. Vp. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

The individual papers in this annual report have been indexed and abstracted.

3793 **Complex fragment emission at low and high excitation energy.** Moretto, L.G. (Univ. of California, Berkeley (USA)). pp 193-227 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

Complex fragment emission has been certified as a compound nucleus process at low energies. An extension of the measurements to heavy ion reactions up to 50 MeV/u shows that most complex fragments are emitted by highly excited compounds nuclei formed in incomplete fusion reactions. 12 references, 26 figures.

3794 **Recoil range studies of reaction mechanisms.** Gadioli, E.; Erba, E.G.; Parker, D.J. (Universita di Milano (Italy)). pp 257-287 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

Studies of reaction mechanism, made by measuring with solid catchers the recoil ranges of radioactive reaction residues, are reviewed. The experimental information one may obtain by these methods is compared to that one gets by means of gaseous or semiconductor detectors or TOF measurements and one shows that the recoil range measurements offer unique possibilities in the case of heavy residues and/or low residue kinetic energies. 34 references, 10 figures.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 3436, 3820

3795 **(BNL—41694) X-ray emission yields from both surfaces of thin targets bombarded with a 200-MeV H/sup minus/ beam.** Vanier, P.E.; Zucker, M.S.; Snead, C.L. Jr. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 10p. (BNL/NPB—88-90; CONF-881151—31). NTIS, PC A02/MF A01. Order Number DE89002939/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

A modified commercial energy-dispersive x-ray spectrometer was used to measure the yields of characteristic x rays from elemental and alloy targets irradiated by a 200-MeV negative-hydrogen beam. In most cases the entry surface, which was bombarded by both electrons and protons, gave about a factor of 2 higher yield than the exit surface where the stripped protons emerged. The results suggest a method of measuring beam profiles where particle densities are too low to be detected electrically by wire arrays. 6 refs., 4 figs.

3796 **(CONF-881232—7) Some applications of Photon/Electron-Rejecting Alpha Liquid Scintillation (PERALS) spectrometry to the assay of alpha emitters.** McDowell, W.J.; Case, G.N. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE88016799/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

The combination of certain solvent extraction separations and a special kind of liquid scintillation detector and electronics designed for alpha spectrometry allows some highly accurate, yet simple determinations of alpha-emitting nuclides. Counting efficiency is 99.68% with backgrounds of <0.02 cpm. Energy resolution and peak position are sufficient for the identification of many nuclides. Rejection of interference from β and γ radiation is $>99.95\%$. The Photon/Electron Rejecting Alpha Liquid Scintillation (PERALS) equipment is described and procedures for the separation and determination of uranium, thorium, plutonium, polonium, radium, and trivalent actinides are outlined. 25 refs., 10 figs., 1 tab.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

3797 **(JINR-R—1-88-6) Breakup of the polarized deuteron darrow upp -> ppn.** Glagolev, V.V.; Lebedev, R.M.; Lykasov, G.I. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704854/JAW.

The experiment has been carried out by means of 100 cm hydrogen bubble chamber exposed to a polarized deuteron beam at 3.3 GeV/c. The estimate of vector polarization of the deuteron P/sub Z/=0.41+-0.09 was made from the analysis of azimuthal distribution of recoil protons in dp -> ppn reaction. A significant difference has been noted in the azimuthal angle distributions between the recoil proton (direct channel) and the recoil neutron (charge exchange). The calculation of the recoil neutron distribution do not agree with the experimental data. 16 refs.; 5 figs.; 1 tab.

3798 **(JINR-R—1-88-23) Spectra of deuterons emitted with large transverse momenta in collisions of 9 GeV/c deuterons with hydrogen, deuterium and carbon nuclei.** Azhgirej, L.S.; Vzorov, I.K.; Zhmyrov, V.N. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1988. 19p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704855/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The high momentum part of the spectra of deuterons at an angle of 0.139 rad in the interactions of 9 GeV/c deuterons with hydrogen, deuterium and carbon nuclei have been measured at the JINR synchrophasotron with a magnetic spectrometer with wire chambers. The differential cross sections of the reaction dp -> dp, dp -> dN* (1410), dp -> dN* (1520), dp -> dn* (1680), dd -> dd, dp -> dpn have been obtained. The experimental data on elastic and quasi-elastic scattering of deuterons, both those obtained in this experiment for t=1.4 (GeV/c)/sup 2/ and in previous measurements for t=0.8 (GeV/c)/sup 2/, are reasonably reproduced within the framework of the multiple scattering model. The parameters of the amplitudes of the elastic scattering of the short-lived nucleon resonances by nucleons have been estimated from the data on reac-

tion H(d,d)N*. These parameter values are compared with quark predictions. 38 refs.; 7 figs.; 3 tabs.

3799 **(JINR-R—1-88-45) Determination of multiscattering process part in dd interactions at 12 GeV/c.** Batyunya, B.V.; Boguslavskij, I.V.; Bruntsko, D. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704858/JAW.

Submitted to the journal Yad. Fiz. .

The multiscattering process part in interaction at 12 GeV/c in a sample of ~ 27000 events are determined. The two independent analysis are used - first based on the direct distinction registered fast proton-spectators, second - followed from the analysis of mean multiplicities of charged particles in dd- and NA-scattering processes. The value of multiscattering process part in accordance with the prediction, calculated within the framework of the Glauber model, are shown. 9 refs.; 4 figs.; 2 tabs.

3800 (ZfK—584, pp 10) **Measurement of the total cross section of the capture reaction /sup 2/H(n,t)/sub γ/ at E/sub n/ = 25 MeV.** Moesner, J.; Moeller, K.; Pilz, W.; Schmidt, G.; Stiehler, T. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3801 (ZfK—584, pp 11) **Off-shell sensitivity of the M1-contribution to the capture reaction n + p -> d + γ.** Moeller, K. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

3802 **(BNL—41823) INC [Intranuclear Cascade] model calculation of (πi, p), ({bar p}, p) and (K^+, p) spectra in the 1 GeV/c range.** Divadeenam, M.; Ward, T.E. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 11p. (CONF-8809143—2; BNL/NPB—88-105). NTIS, PC A03/MF A01. Order Number DE89002180/JAW.

From Hypernuclear and low-energy kaon physics; Padova, Italy (12 Sep 1988).

The proton inclusive spectra measured with 800 MeV/c π^+ beam (BNL) on light nuclei, and the 600 MeV/c {bar p} beam (LEAR) on ^{6}Li and ^{63}Cu have been successfully interpreted in terms of the Intranuclear Cascade (INC) Model. According to the INC model predictions the {bar p} induced reaction results in high pion yield for the light ^{6}Li target case. This is attributed to the nonavailability of nucleons to be knocked out by the pions produced following the {bar p} annihilation. While in the case of the heavier ^{63}Cu target some of the internally produced pions are subsequently absorbed leading to thermal equilibration of the nuclear medium, resulting in a softer proton spectrum at the high energy end. Based on the INC model predictions, the K^+ induced reactions could be studied to search for the "true resonances" beyond 1 GeV K^+ energy. 10 refs., 7 figs.

3803 **(JINR-R—1-87-941) Observation of nucleon-carbon interactions at P/sub 0/=4.2 and 10 GeV/c with the summary kinetic energy of secondary particles higher than the incident one.** Kopylova, D.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704853/JAW.

Inelastic events with fast forward particles have been observed among p(C/sub 3/H/sub 8/) and n(C/sub 3/H/sub 8/) interactions at P/sub 0/=4.2 GeV/c and p(C/sub 3/H/sub 8/) interactions at P/sub 0/=10 GeV/c detected in a 2 m propane bubble chamber. In these events the sum of the kinetic energies of fragments and the total energies of produced paricles, T/sub meas/ =Σ(T/sub i/)/sub fr/+Σ(T/sub i/+m/sub π/), exceeds the kinetic energy of the projectile (T/sub 0/). Assuming maximum and minimum errors of ΔT/sub meas/, the limits of veriation of T/sub meas/-T/sub 0/ have been found in the events with T/sub meas/> T/sub 0/. Using the statistical methods of identification of fast positive particle, T/sub meas/ > T/sub 0/=(0.19-0.51) GeV with a statistical error of 0.09 GeV for the events of P/sub 0/=4.2 GeV/c, and it is equal to (0.59-1.33)+-0.21 GeV for P/sub 0/=10 GeV/c. This corresponds to the number of events with T/sub meas/ > T/sub 0/ from 3 to 9%. In the group of events with T/sub meas/ > T/sub 0/ a (2-3) fold increase of energy release for π/sup -/-mesons has been observed as compared to the events without selection. The conclusion can be drawn that the evens with T/sub meas/ > T/sub 0/ cannot be completely interpreted as a consequence of methodic errors. 11 refs.; 4 figs.; 4 tabs.

3804 **(JINR-R—1-88-33) Energy dependence of pion yield in p + C -> π/sup +-/(159/sup 0/) + x reaction for protons with energy from 15 to 67 GeV.** Belyaev, I.M.; Frolov, S.V.; Gavrishchuk, O.P.; Zarubin, P.I.; Zolin, L.S.; Peresedov, V.F.; Rukoyatkin, P.A.; Sukhanov, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704856/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The invariant cross sections of π/sup +/ and π/sup -/-meson production have been measured at an angle of 159 deg for the cumulative variable 0.6 ≦X≦2.0 in interactions of protons having energy E/sub 0/ from 15 to 61 GeV with carbon nuclei. The energy dependence of pion yield in this interval (E/sub 0/) shows a scaling behaviour at X < 1 and in the cumulative region X > 1. The dependence of the ratio of π/sup +/ and π/sup -/ meson production on enrgy E/sub 0/ and pion momentum is considered. 11 refs.; 11 figs.; 2 tabs.

3805 **(JINR-R—1-88-34) Cross sections of pions production at an angle of 159/sup 0/ for interaction of protons having an energy from 15 to 61 GeV carbon nuclei.** Belyaev, I.M.; Frolov, S.V.; Gavrishchuk, O.P.; Zarubin, P.I.; Zolin, L.S.; Peresedov, V.F.; Rukoyatkin, P.A.; Sukhanov, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704857/JAW.

The invariant cross sections of π/sup -/- and π/sup +/-production have been measured at an angle of 159 deg for interactions of protons having an energy from 15 to 61 GeV with carbon nuclei. The data are presented in the tables for the differential cross sections of pion production and their ratios in 7 energy intervals with a meson energy of primary protons 17,22,28,34,41,47 and 57 GeV. 6 refs.; 6 tabs.

3806 (ZfK—584, pp 9) **Hadron and fragment emission in cluster excitation processes at medium energies.** Mueller, H.; Schneidereit, C.; Kovacs, Z. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3807 (ZfK—584, pp 14) **About the possibility of a bound /sup 12/C-/sup 12/C quasimolecular band in /sup 24/Mg.** Gersch, H.U.; Goldberg, V.; Rudakov, V. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Institute of Atomic Energy, Moscow (USSR)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3808 **Experimental studies of the reaction mechanism of incomplete fusion.** Morgenstern, H.; Bohne, W.; Grabisch, K.; Seniwongse, G.; Galster, W. (Hahn-Meitner-Institute, Berlin (West Germany)). pp 229-255 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

Velocity spectra of evaporation residues produced in reactions with reverse kinematics (^{40}Ar + ^{11}B, /sup 12,13/C at 7 MeV/amu) have been measured inclusively and in coincidence with charged light particles. The results indicate that the residues due to incomplete-fusion reactions originate from cluster transfer reactions with distinct Q-values and with angular momenta in the entrance channel less than the critical angular momentum l/sub cr/ for complete fusion. No significant dependence on the target structure is observed. 18 references, 10 figures, 1 table.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

3809 **Nonresonant capture of low-energy protons by /sup 27/Al.** Hardie, G.; Segel, R.E.; Elwyn, A.J.; Monahan, J.E. (Physics Department, Western Michigan University, Kalamazoo, Michigan 49008). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 5, 2003-2012(Nov 1988).

Excitation functions for the /sup 27/Al(p,γ)/sup 28/Si reaction have been obtained over the energy range E/sub p/ = 0.5--1.8 MeV. Capture was studied to the ground state (0^+) and the first excited state (2^+) at E/sub x/ = 1779 keV. Detailed angular distributions were obtained in the energy region near E/sub p/ = 850, 1060, 1140, and 1623 keV. The data are compared with direct capture calculations which employ a real Woods-Saxon well in both the entrance channel and the final state. The analysis of the data provides no evidence for the presence of a significant semidirect contribution.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

3810 (ZfK—584, pp 20) **Mean lifetimes of positive-parity states in /sup 79/Br.** Schwengner, R.; Winter, G.; Doering, J.; Funke, L.; Rotter, H. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3811 (ZfK—584, pp 21) **New ps - lifetimes and electromagnetic transition probabilities in /sup 79/Kr.** Winter, G.; Schwengner, R.; Funke, L.; Doering, J. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3812 (ZfK—584, pp 22) **Subnanosecond isomers in /sup 87/Y.** Kostov, L.K.; Andrejtscheff, W.; Kostova, L.G.; Petkov, P.; Prade, H.; Rotter, H.; Kaeubler, L.; Stary, F. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

3813 (ZfK—584, pp 23) **Lifetime measurements in /sup 123,125/I.** Kostova, L.G.; Andrejtscheff, W.; Kostov, L.K.; Petkov, P.; Kaeubler, L.; Prade, H.; Rotter, H.; Stary, F. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3814 (ZfK—584, pp 24) **Magnetic moment of the 10/sup +/ isomer in /sup 140/Ce and temperature dependence of the paramagnetism for Ce ions in BaO.** Kaeubler, L.; Prade, H.; Enghardt, W.; Stary, F.; Carle, P.; Norlin, L.O.; Rensfelt, K.G.; Rosengard, U. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Forskningsinstitutet foer Atomfysik, Stockholm (Sweden)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

3815 **(JINR-R—6-87-931) Search and observation of E1-gamma-transition with 7.13 keV energy in decay of /sup 160/Er->/sup 160/Ho.** Gorozhankin, V.M.; Vylov, Ts.; Gromov, K.Ya.; Kalinnikov, V.G.; Kovalik, A.; Lebedev, N.A.; Novgorodov, A.F.; Brabec, V.; Dragoun, O.; Vasil'ev, S.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky; Radievyj Inst., Leningrad (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704873/JAW.

Submitted to the Meeting on Nuclear Spectroscopy and Atomic Nuclear Structure (Baku, April 1988) and to the journal Izv. Akad. Nauk SSSR, Ser. Fiz. .

The E1-transition with 7.13 keV energy has been found in electron and gamma-ray spectra of /sup 160/Er decay. The energy and other characteristics of I/sup +/-level in /sup 160/Ho predicted earlier are determined. 14 refs.; 7 figs.; 1 tab.

3816 **(SLAC-PUB—4728) Distribution of induced activity in tungsten targets.** Donahue, R.J.; Nelson, W.R. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 11p. (CONF-880729—4). NTIS, PC A03/MF A01. Order Number DE89002397/JAW.

From 33. annual meeting of the Health Physics Society; Boston, MA, USA (4 Jul 1988).

Estimates are made of the induced activity created during high-energy electron showers in tungsten, using the EGS4 code. Photon track lengths, neutron yields and spatial profiles of the induced activity are presented. 8 refs., 9 figs., 1 tab.

3817 (ZfK—584, pp 26) **Cascade-model studies of lambda-particle production in the carbon on tantalum reaction at Dubna energies.** Barz, H.W.; Iwe, H. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3818 **Anomalous conversion-electron intensity ratio of the E0 transitions in ^{154}GD.** Sakai, M. (Univ. of Tokyo (Japan)). pp 353-367 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

Relative probabilities of the E0 internal conversion for the K-, L-, M- and N+O-shells in the transitions of ^{154}Gd have been precisely determined by means of special electron measuring techniques. They were compared with the theoretically predicted values. It turned out that K conversion is hindered relative to the L conversion in comparison with the theoretical prediction and even the L conversion is hindered relative to the M and N+O conversions. 20 references, 7 figures, 4 tables.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

3819 **(JINR-E—7-87-580) On search for density isomers in interaction of relativistic /sup 12/C nuclei with lead.** Avdeev, S.P.; Karnaukhov, V.A.; Kuznetsov, V.D.; Petrov, L.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704850/JAW.

Submitted to 9. Europhysics Study Conference From Cold to Hot Nuclei, September 1987, Bulgaria, Varna and to the journal Z. Phys. .

Pb target was bombarded with /sup 12/C nuclei of an energy of 15 and 43 GeV. The target was periodically transported to the inside of the neutron multiplicity detector which allowed to measure the time spectra for events of multiple emission of delayed neutrons. Abnormal neutron emitters have not been found. Upper limits of probabilities of their production were estimated for the half-life range 10-10/sup 5/ s and for different mean multiplicities of neutrons (n). The values obtained are within the interval from 1.4X10/sup -9/ (for n=12) to 4X10/sup -6/ (for n=2). 17 refs.; 4 figs.; 1 tab.

3820 **(LBL—25810) Multiple dissociation of ^{16}O, ^{14}N, and ^{12}C at 32.5 MeV/nucleon.** Stokstad, R.G.; Chan, Y.D.; Dacal, A.; DiGregorio, D.E.; Harmon, B.A.; Knop, R.; Ortiz, M.E.; Plagnol, E.; Pouliot, J.; Moisan, C. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 17p. (CONF-8809118—2). NTIS, PC A03/MF A01. Order Number DE89002668/JAW.

From 20. international summer school on nuclear physics; Mikolajki, Poland (2 Sep 1988).

An array of 34 fast/slow plastic scintillators has been used to identify fragments from the breakup of ^{16}O, ^{14}N, and ^{12}C projectiles at 32.5 MeV/nucleon, scattered by a Au target. The dissociation of ^{16}O into as many as five charged particles has been observed. The yields of the different channels correlate approximately with the threshold energy for separation of the projectile into the observed fragments. The excitation spectrum of the primary projectile fragment was deduced from the measured positions and kinetic energies of the individual fragments. These spectra show that, although most of the decomposition proceeds through excitation energies within {approximately}20 MeV of the lower particle-decay thresholds, excitation energies extending up to {approximately}80 MeV can be produced in the primary stage of the reaction. This represents a significant acquisition of energy by the projectile. Calculations of the yields based on a sequence of binary decays have been presented. Reactions in which one or two units of charge are acquired by the projectile were also observed. 25 refs., 10 figs.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

3821 **(DOE/ER/40414—1) Studies of heavy-ion reactions and transuranic nuclei: Progress report, September 1, 1987--August 31, 1988.** Schroeder, W.U.; Huizenga, J.R. (Rochester Univ., NY (USA). Dept. of Chemistry and Physics). Aug 1988. Contract FG02-88ER40414. 244p. NTIS, PC A11/MF A01. Order Number DE89002732/JAW.

The effect of successively increasing gradients of the potential energy surface on mass and charge transport was studied experimentally and theoretically with a series of damped reactions induced by ^{48}Ca, ^{64}Ni, ^{58}Ni, and ^{40}Ca projectiles on ^{238}U targets. Combined transport-evaporation calculations that were performed for the interpretation of data demonstrate a systematic deficiency of quantitative reaction theory. A new type of experimental method has been employed to study several moments of the energy partition in damped reactions, measuring multiplicity correlations of neutrons emitted from the asymptotic fragments with a specially designed, directionally sensitive multiplicity counter. First results indicate significant departures of damped reaction systems from thermal equilibrium. Employing realistic Monte Carlo simulation of published experiments, it was demonstrated that the directions of net mass transfer and energy deposit are uncorrelated in damped reactions. Evaporative and preequilibrium neutron emission has been studied for the asymmetric heavy-ion system ^{139}La + ^{40}Ar. The disequilibrium energy transport phenomena observed in the experiment are quantitatively reproduced by model calculations. A strong impact-parameter dependence of preequilibrium emission is demonstrated. The emission patterns of α particles evaporated from high spin compound nuclei, previously attributed to exotic nuclear shapes, have been explained in realistic statistical model calculations for nuclei with conventional shapes. A new octal digital delay module has been designed and tested.

3822 **(ITEF—36(1988)) Measurement of p-odd asymmetry of fragment escape in ternary fission of plutonium 239.** Belozerov, A.V.; Vodennikov, B.D.; Danilyan, G.V.; Korobkina, E.I.; Pavlov, V.S.; Pevchev, Yu.F.; Sadchikov, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704813/JAW.

Values of effects of parity nonconservation in binary and ternary fission of plutonium 239 by polarized thermal neutrons were measured simultaneously. The ratio of asymmetry coefficient (AC) of ternary fission to the AC of binary fission was equal to 0.67+-0.20. The obtained result testifies to insignificant disagreement of AC of fragment escape in studied fission types. 6 refs.; 2 figs.

3823 **(LBL—26112) Recent research on the heavy transuranium elements.** Seaborg, G.T. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 41p. (CONF-8810114—1). NTIS, PC A03/MF A01. Order Number DE89002961/JAW.

From Symposium on transuranium elements today and tomorrow: properties, prospects, problems; Karlsruhe, F.R. Germany (26 Oct 1988).

This review is devoted to recent research (performed in the 1980s) on the heavy members of the group, defined as the transcurium elements (with a few references to related work on lighter elements). It covers the discovery of the three heaviest elements, the discovery of new isotopes, investigation of interesting decay properties of some previously known isotopes, investigations of some heavy ion reaction mechanisms in this region, and recent investigations of nuclear and chemical properties. It is not exhaustive in its coverage, is necessarily succinct, and inevitably places emphasis on those aspects with which the author is most familiar. 92 refs., 3 figs.

3824 (ZfK—584, pp 2) **Total kinetic energy versus mass distributions obtained by investigation of the systems /sup 22/Ne + /sup 249/Cf and /sup 56/Fe + /sup 208/Pb.** Gippner, P.; Schilling, K.D.; Seidel, W.; Stary, F.; Will, E.; Sodan, H.; Lukyanov, S.M.; Chubarian, G.G.; Salamatin, V.S.; Penionzhkevich, Yu.E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Joint Inst. for Nuclear Research, Dubna (USSR)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3825 (ZfK—584, pp 3) **In-beam investigations of ternary fission at the Rossendorf cyclotron U-120.** Kotte, R.; Ortlepp, H.G.; Keller, H.J.; Stary, F.; Hentschel, E.; Fiedler, J. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3826 (ZfK—584, pp 5) **Absolute measurement of the U-238 fission cross-section at 18.8 MeV neutron energy using the TCAPM.** Herbach, C.M.; Merla, K.; Musiol, G.; Pausch, G.; Ortlepp, H.G.; Drapchinsky, L.W.; Ganza, E.A.; Shpakov, V.I.; Solovjev, S.M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Radievyj Inst., Leningrad (USSR)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3827 (ZfK—584, pp 6) **Theoretical study of fission neutron emission during fragment acceleration.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3828 (ZfK—584, pp 7) **About the mean-square radii of the 236-U nucleus in excited states with different fission widths.** Meister, A.; Mittag, S.; Pilz, W.; Seeliger, D.; Seidel, K.; Pikelner, L.B. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Joint Inst. for Nuclear Research, Dubna (USSR)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3829 (ZfK—584, pp 8) **Angular correlations and mass loss in 1 GeV proton-nucleus collisions.** Andronenko, L.N.; Andronenko, M.N.; Kotov, A.A.; Vaishnene, L.A.; Neubert, W. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3830 (ZfK—584, pp 4) **Results of absolute fission cross-section measurements of Pu-239 at 4.8, 8.65 and 18.8 MeV neutron energy using the TCAPM.** Herbach, C.M.; Merla, K.; Musiol, G.; Pausch, G.; Ortlepp, H.G.; Alkhazov, I.D.; Drapchinsky, L.V.; Ganza, E.A.; Kovalenko, S.S.; Kostochkin, O.I. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3831 **Excitation of actinide nuclei.** Sheldon, E.; Egan, J.J.; Goswami, G.C.; Kegel, G.H.R.; Mittler, A. (Univ. of Lowell, MA (USA)). pp 117-136 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

Fast-neutron differential and angle-integrated cross sections for inelastic scattering to low-lying rotational states of the actinide nuclei ^{232}Th, /sup 235,238/U, /sup 240,242/Pu, as newly measured and computed by the Lowell group, are given for incident energies up to 2.5 MeV, supplementing previous (Mikoiajki 1984) results for the vibrational levels. The experimental and theoretical angular distributions and excitation functions, measured with the direct (n,n') time-of-flight technique with subnanosecond time resolution and calculated with various (CN + DI and statistical S-matrix) formalisms using Bruyeres parameters, are also contrasted with the ENDF/B-V evaluation. 54 references, 9 figures, 2 tables.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 3449, 3725, 3735, 3759, 3760, 3761, 3791, 3793, 3831, 3998

3832 **(DOE/ER/40251—3) Theoretical interpretation of data obtained in high energy nuclear collisions: Progress report, January 1, 1988--September 30, 1988.** Fai, G. (Kent State Univ., OH (USA)). 26 Sep 1988. Contract FG02-86ER40251. 11p. NTIS, PC A02/MF A01. Order Number DE89002720/JAW.

Data obtained in nuclear collisions at energies ranging from medium to relativistic are interpreted theoretically. The major objective is a better understanding of high-energy heavy-ion collisions, with special emphasis on the general properties of excited nuclear matter. The equation of state of nuclear matter is sought. Particular attention is paid to possible phase transitions. Statistical methods are augmented with more dynamical considerations. The effect of fragment interactions on the disassembly of the excited nuclear system is investigated. Experimentally important phenomenological questions are discussed. Study also centers on nonlinear phenomena in model field theories.

3833 **(DOE/ER/40322—049) Theoretical studies in nuclear reactions and nuclear structure: Progress report.** Griffin, J.J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Sep 1988. Contract FG05-87ER40322. 76p. NTIS, PC A05/MF A01. Order Number DE89002259/JAW.

This report discusses topics in nuclear theory. These general topics are: Quark physics, Quantum field theory, Relativistic nuclear physics, Nuclear dynamics, and Few-body problems and nonrelativistic methods. (LSP)

3834 **(GSI—88-36(prepr.)) Systematics of momentum distributions from reactions with relativistic ions.** Morrissey, D.J. (Michigan State Univ., East Lansing (USA). Dept. of Chemistry). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Michigan State Univ., East Lansing (USA). Dept. of Chemistry). Jul 1988. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755569/JAW.

The momentum distributions of projectile and target residues from spallation reactions induced by relativistic projectiles already in the literature are transformed into consistent quantities and compared. The momentum imparted to the residual nucleus is presented in terms of a longitudinal velocity, $<\beta/$sub parallel/$>$, and a root mean squared momentum, P/sub rms/. These parameters from all spallation products from many disparate systems display the same systematic dependence on observed mass loss. The rms momentum is shown to depend on the square root of the observed mass loss due to momentum conservation in either of three competing processes with no dependence on the initial reaction. The longitudinal momentum is shown to depend on the observed mass-loss and therefore on the excitation energy with a only kinematical factor

from the entrance channel. Thus, the longitudinal momenta depend on the velocity but not the mass of the reaction partner.

3835 (IAEA-TECDOC—469, pp 23-32) **Level density of excited nuclei.** Ignatyuk, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). Aug 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704485/JAW. (CONF-8705343—).

From Interregional training course on neutron physics and neutron data measurements with accelerators and research reactors; Leningrad, USSR (18 May 1987).

The paper describes the development of level density theory for excited nuclei, taking into account the shell, superfluid and collective characteristics of the nuclei. (author). 20 refs, 6 figs.

3836 **(IC—87/362) Concerning moderate seniority mixing and the high spin states of some N=50 isotones.** Amusa, A. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1987. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704691/JAW.

The high spin states of some N=50 isotones are studied in a shell model scheme involving the restriction of the valence nucleons to 2p/sub 1/2/ and 1g/sub 9/2/ orbits as well as the use of an interaction that has slight seniority non-conservation. Our results indicate that the high spin states of these nuclei, in direct contrast to their low spin states, have extra-(2p/sub 1/2/,1g/sub 9/2/)/sup n/ space contributions that support violation of seniority conservation. (author). 17 refs, 2 figs, 1 tab.

3837 **(IC—88/59) Coupling effect in π-N scattering within the Skyrme model.** Zhang Meiman; Li Bingan. (International Centre for Theoretical Physics, Trieste (Italy); Kentucky Univ., Lexington (USA). Dept. of Physics and Astronomy). (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704694/JAW.

The equations of π-N scattering in the Skyrme model are derived from PCAC. The method used to calculate the coupling effects between the rotation and vibration models is presented. (author). 5 refs, 2 figs.

3838 **(IC—88/104) Theory of spontaneous cluster-decay of radioactive nuclei.** Gupta, R.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704215/JAW.

In a model of weakly coupled motions in mass-asymmetry and relative separation coordinates, the spontaneous cluster-decay of radioactive nuclei is treated as a two-step mechanism of clustering formation and tunnelling of the confining nuclear interaction barrier. The clustering formation is calculated as the quantum mechanical fragmentation probability and the tunnelling probability is given by the WKB penetrability which is solved analytically. Application of the model is also made to the possible decay of "stable" nuclei, lighter than Pb. (author). 34 refs, 2 figs, 5 tabs.

3839 **(IC—88/175) Spin of two-nucleon system and nucleon-antinucleon combination in the S-state.** Baranik, A.T.; El-Naghy, A.; Ramadan, S. (Cairo Univ. (Egypt). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704725/JAW.

The spin of the two nucleon combination was studied. It was found that the resultant combination could be treated as a boson with spin one or zero, and the spin one state is more stable than the spin zero state. In the case of nucleon-antinucleon combination the spin zero state is more stable than the spin one state. The approach succeeded in describing the general features of the nucleon-nucleon and nucleon antinucleon scattering and polarization. (author). 3 refs, 4 figs.

3840 **(ITEP—150(1987)) Topological cross sections in hadron-nucleus collisions and multiple scattering theory.** Zoller, V.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704826/JAW.

The multiple scattering theory supplemented with cutting rules of Abramovsky, V.A., Gribov, V.N., Kancheli, O.V. is applied to calculation of the hadron-nucleus interaction cross sections. In contrast to standard Glauber approach neither smalness of the interaction radius compared to the nuclear radii nor Gaussian form of the hN-interaction profile function are assumed. The theory of the supercritical pomeron are used. However all the results are more general and do not depend on the parametrization of the pomeron pole amplitude. The region of validity of the widely used approximate formulae for topological and total hA-interaction cross sections are discussed. 24 refs.; 2 figs.

3841 **(JINR-E—2-88-22) Angular distributions of Λ's from central collisions of light nuclei in cascade model approach.** Iwe, H.; Okonov, E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704842/JAW.

Lambda particle production in central C+C-reactions at an energy of 3.66 A GeV is considered within the framework of the intranuclear cascade model CASIMIR and compared with available experimental data. On the basis of sequential binary collisions it is very difficult to understand the isotropic features in the lambda production found in central C+C, C+Ne and O+Ne-collisions. 19 refs.; 3 figs.

3842 **(JINR-E—4-87-927) Symplectic classification of the even-even nuclei and nuclear spectra.** Georgieva, A.; Ivanov, M.; Roussev, R.; Raychev, P. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704847/JAW.

The generalization of the approach according to which spectra of even-even nuclei unite into F-spin multiplets is suggested. All even-even nuclei with valent nucleons pertaining to one shell are considered as a unified symplex multiplet. The above model makes use of some main concepts of the IBM-2 model but at the same time greatly differs from it. At this stage only phenomenologic features of even nuclei spectra are discussed. 10 refs.; 3 figs.; 2 tabs.

3843 **(JINR-E—4-88-36) Improved optical potential for low-energy pion-nucleus scattering.** Khankhasaev, M.Kh.; Topil'skaya, N.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; AN SSSR, Moscow. Inst. Yadernykh Issledovanij). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704848/JAW.

Submitted to the journal Phys. Lett., B.

A new procedure for calculating the imaginary part the of Stricker, McManus and Carr (SMC) optical potential is proposed. It is based on an approximate expression for the pion-nucleon scattering amplitude including nuclear structure effects. It is shown that the resulting potential with the absorption parameters fitted to the pionic atom data provides a good description of the scattering up to 50 MeV. 15 refs.; 4 figs.; 1 tab.

3844 (JINR-E—4-88-79) Gamow-Teller β/sup +/ decays and strength functions of (n,p) transitions in spherical nuclei. Kuz'min, V.A.; Solov'ev, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704849/JAW.

Submitted to the journal Nucl. Phys., A.

The effect of particle-particle interaction on the Gamow-Teller β/sup +/ decay and strength functions of (n,p) transitions is studied. The integrated logft values for the GT decays of /sup 152/Yb, /sup 152,150/Er, /sup 146,148/Dy and /sup 96/Pb are calculated in the RPA with separable particle-hole and particle-particle interactions. A good description of logft is obtained with the constants k/sub 1//sup 01/-23/A MeV and G/sub 1//sup 01/=7.5/A MeV at]g/sub A//g/sub V/[=1 and H/sub 1//sup 01/=7.9/A MeV at]g/sub A//g/sub V/[=1.25. From the available experimental data on β/sup +/ decay of nuclei far from stability one cannot conclude that the weak axial-vector constant g/sub A/ is strongly renormalized in nuclei. The particle-particle interaction is shown to influence strongly the total strength S/sub +/ of (n,p) transitions by diminishing it (1.5-3.0) times. For the reaction /sup 54/Fe(n,p)/sup 54/Mn at forward angles the calculated value S/sub +/=4.2 is in agreement with the experimental one. 29 refs.; 2 figs.; 4 tabs.

3845 (JINR-R—2-87-904) Six-quark clusters in nuclear matter at low temperatures. Shanenko, A.A.; Shumovskij, A.S.; Yukalov, V.I. (Moskovskij Gosudarstvennyj Univ. (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704860/JAW.

Submitted to International J. of Modern Physics, A.

The two-phase system consisting of nucleons and six-quark clusters is investigated. The interaction between nucleons and six-quarks is represented by a sum of the fermi and Yukawa potentials. The temperature behaviour of nucleon and six-quark concentrations versus density is found. It is shown that with a normal nuclear density, six-quark clusters may amount to about 10%, which is in agreement with experiment. 23 refs.; 1 fig.

3846 (JINR-R—4-87-917) On the role of the Coriolis and quasiparticle-phonon intera ctions for the description of E1-transition probabilities in odd Eu and Tb isotopes. Alikov, B.A.; Badalov, Kh.N.; Vavryshchuk, Ya.; Nesterenko, V.O.; Sushkov, A.V. (Tashkentskij Gosudarstvennyj Univ. (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 26p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704869/JAW.

Submitted to the journal Z. Phys., A. - Atoms and Nuclei.

It is shown in the framework of microscopic approach, including the quasiparticle-phonon model and nonadiabatic rotational model (QPM+NRM), that the complex behaviour of E1-transitions in /sup 153,155/Eu and /sup 155,157/Tb nuclei can be described only when the Coriolis and quasiparticle-phonon interactions are taken into account simultaneously. In comparison with the predictions of NRM which takes into account the Coriolis interaction only, our calculations result in much stronger E1(ΔK=0) translations and in both stronger and essentially weaker E1(chemical bondΔKchemical bond)=1) transitions. The description of low-lying states of these nuclei is also obtained and E1-transitions in appropriate even-even cores are investigated. It is shown that E1-transitions between low-lying states in even-even and odd nuclei are generated mainly by the "tail" of a giant dipole resonance. The obtained results are analysed in detail. 28 refs.; 1 fig.; 9 tabs.

3847 (KIYI—86-44) Determination of the nuclear equilibrium shapes in the liquid drop model with restrictions. Ivanyuk, F.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1986. 37p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704303/JAW.

The computer code is described computing the nuclear shape of equilibrium from the liquid drop energy minimum principle with the additional restrictions fixing the deformation and asymmetry of the nuclear shape. The code is based on the algorithm developed earlier in the papers by V. M. Strutinsky. In comparison to these papers the capacity of the code is extended by introducing an additional condition fixing the left-right asymmetry of the nuclear shape. 5 refs.; 1 fig.

3848 (LA-UR—88-3320) Intermediate-energy hadron interactions, II. Silbar, R.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-880983—10). NTIS, PC A03/MF A01. Order Number DE89002047/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

The topics to be covered are as follows. I'll begin with new developments in NN → NNπ reactions. This will provide a natural lead-in to the main topic of this talk, which is dibaryons. This will be followed by discussion of elastic proton-deuteron and inelastic proton-alpha scattering. Then there will be a brief mention of two technical developments. Finally, I'll close by giving short remarks about two peculiarities that were found by theorists looking at strong interaction amplitudes. 15 refs., 3 figs.

3849 (LA-UR—88-3604) First polarization results from the LAMPF ^{13}C target. Penttila, S.I.; Amann, J.F.; Jarmer, J.J.; Jones, K.W.; Tanaka, N.; Barlett, M.L.; Hoffmann, G.W.; Kielhorn, W.F.; Pauletta, G.; Purcell, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880983—9). NTIS, PC A02/MF A01. Order Number DE89002294/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

A polarized ^{13}C target has been developed and used to measure spin observables for 500-MeV p - ^{13}C elastic scattering. The material was ethylene glycol, $^{13}C_2H_6O_2$, enriched to 99% in ^{13}C. Both the ^{13}C and ^{1}H spins were dynamically polarized in a ^{3}He refrigerator at 2.5-T magnetic field. The polarization of both species was measured by using the NMR thermal equilibrium calibration technique. In addition, the polarization of ^{1}H was independently measured by p-p scattering. We described the target and reported on the polarizations obtained and the dependence of the polarizations on integrated beam intensity. 9 refs., 3 figs., 1 tab.

3850 (LA-UR—88-3620) Double beta decay: A theoretical overview. Rosen, S.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 23p. (CONF-8806204—6). NTIS, PC A03/MF A01. Order Number DE89002291/JAW.

From 13. international conference on neutrino physics and astrophysics; Boston, MA, USA (5 Jun 1988).

This paper reviews the theoretical possibility of double beta decay. The titles of the main sections of this paper are: Nuclear physics setting; Particle physics requirements; Kinematical features of the decay modes; Nuclear matrix elements; the Shell model and two-neutrino decay; Quasi-particle random phase approximation; and Future considerations. 18 refs., 7 tabs. (LSP)

3851 (TRITA-EPP—87-11) Beta limitation of matter-antimatter boundary layers. Lehnert, B. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research). Aug 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755139/JAW.

A model has earlier been proposed for a boundary layer which separates a cloud of matter from one of antimatter in a magnetized ambiplasma. In this model steady pressure equilibrium ceases to exist when a certain beta limit is exceeded. The latter is defined as the ratio between the ambiplasma and magnetic field pressures which balance each other in the boundary layer. Thus, at an increasing density, the high-energy particles created by annihilation within the layer are 'pumped up' to a pressure which cannot be balanced by a given magnetic field. The boundary layer then 'disrupts'. The critical beta limit thus obtained falls within the observed parameter ranges of galaxies and other large cosmical objects. Provided that the considered matter-antimatter balance holds true, this limit is thus expected to impose certain existence conditions on matter-antimatter boundary layers. Such a limitation may apply to certain cosmical objects and cosmological models. The maximum time scale for the corresponding disruption development has been

estimated to be in the range from about 10/sup -4/ to 10/sup 2/ seconds for boundary layers at ambiplasma particle densities in the range from 10/sup 4/ to 10/sup -2/ m/sup -3/, respectively.

3852 (ZfK—584, pp 27) **Population of hypernuclear states via nucleon decay channels.** Wuensch, R.; Majling, L.; Zofka, J. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3853 (ZfK—584, pp 28) **Electromagnetic radiation of rotating nuclei.** Doenau, F. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3854 (ZfK—584, pp 29) **Critical behaviour of collective fluctuations.** Pfitzner, A. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3855 (ZfK—584, pp 12) **Phenomenology of angular distributions of 14-MeV-neutron-inelastic scattering: systematics and theoretical approaches.** Hermsdorf, D.; Kalka, H. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3856 (ZfK—584, pp 17) **Quenching of the correlation function at the Hanbury Brown-Twiss effect.** Gersch, H.U. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3857 (ZfK—584, pp 18) **MAT 1402 and MAT 8201 - two revised versions of evaluated neutron nuclear data files for silicon and lead for BROND.** Hermsdorf, D.; Blokhin, A.V.; Ignatyuk, A.V. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3858 (ZfK—584, pp 19) **On the use of nuclear data libraries in GDR - updating and extension of data bases and nuclear data service.** Eckstein, S.; Hermsdorf, D.; Seeliger, D.; Friedrich, K.; Jankowski, L.; Letz, B. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3859 (ZfK—584, pp 25-26) **Hadron yields from the decaying quark gluon plasma.** Kaempfer, B.; Barz, H.W.; Lukacs, B. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3860 (ZfK—584, pp 30) **Target-mass dependence of preequilibrium neutron yields in heavy ion collisions.** Maedler, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3861 (ZfK—584, pp 31) **Incident-energy and projectile-mass dependence of preequilibrium neutron yields in heavy ion reactions.** Biedermann, M.; Maedler, P. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3862 (ZfK—584, pp 32) **Coupling between energy- and mass-equilibration in HIC.** Schmidt, R. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3863 (ZfK—584, pp 33) **Simple model to approximate TDHF results on fast particle emission.** Biedermann, M.; Maedler, P. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3864 (ZfK—584, pp 34) **Azimuthal correlations between two fast particles within the two-stage model.** Biedermann, M.; Maedler, P. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3865 (ZfK—584, pp 35) **Comparison of the two-stage model for fast particle emission with hot-source parametrizations.** Biedermann, M.; Maedler, P. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3866 (ZfK—584, pp 37) **Angular distributions from Gamow states in /sup 17/O + /sup 16/O.** Fandrich, J.; Milek, B.; Reif, R. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3867 (ZfK—584, pp 36) **Polar particle emission in spontaneous fission.** Milek, B.; Reif, R.; Revai, J. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3868 Deformation of rotating nuclei. Bengtsson, R. (Lund Institute of Technology (Sweden)). pp 1-35 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

The deformation of atomic nuclei at high angular momentum is discussed based on theoretical results obtained by using the cranking model description of rotating nuclei. Comparisons with experimental data show that the calculated deformations are consistent with the general structure of the observed excitation energy spectra. 30 references, 24 figures.

3869 Multiphoton method as a dynamical approach to octupole correlations in deformed nuclei. Piepenbring, R. (Institut des Sciences Nucleaires, Grenoble (France)). pp 37-84 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

The octupole correlations in nuclei are studied within the framework of the multiphonon method which is mainly the exact diagonalization of the total Hamiltonian in the space spanned by collective phonons. This treatment takes properly into account the Pauli principle. It is a microscopic approach based on a reflection symmetry of the potential. The spectroscopic properties of double even and odd-mass nuclei are nicely reproduced. The multiphonon method appears as a dynamical approach to octupole correlations in nuclei which can be compared to other models based on stable octupole deformation. 66 references, 3 figures, 6 tables.

3870 Proton-neutron interaction and nuclear structure. Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)). pp 85-115 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—). Contract AC02-76CH00016.

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

The pervasive role of the proton-neutron interaction in nuclear structure is discussed. Particular emphasis is given to its influence on the onset of collectivity and deformation, on intruder states, and on the evolution of subshell structure. The N/sub p/N/sub n/ scheme is outlined and some applications of it to collective model calculations and to nuclei far off stability are described. The concept of N/sub p/N/sub n/ multiplets is introduced. 32 references, 20 figures.

3871 Relativistic mean-field theories and nuclear properties. Reinhard, P.G.; Rufa, M.; Fink, J.; Maruhn, J.; Stoecker, H.; Greiner, W.; Lee, S.Y.; Umar, S.; Strayer, M.R.; Cusson, R.Y. (Institut fuer Theoretische Physik, Erlangen (West Germany)). pp 137-163 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

The nucleus is described as consisting out of relativistic nucleons and explicit mesonic degrees-of-freedom which are considered to be the relativistic generalization of the Skyrme force. The meson-parameters can be adjusted such that the model gives an excellent description of spherical nuclear ground states. First axially symmetric deformed calculations are presented. Dynamic calculations of relativistic ^{16}O - ^{16}O scattering are also done; they show pronounced effects of the mesonic degrees-of-freedom. 24 references, 3 figures, 3 tables.

3872 Studies of isovector excitations in nuclei by neutron-induced reactions. Nilsson, L. (Uppsala Univ. (Sweden)). pp 165-191 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

In this paper isovector excitations in nuclei, in particular the giant isovector quadrupole resonance in spherical nuclei, will be discussed. Several methods to investigate this excitation have been used, e.g. inelastic electron scattering and charge-exchange reactions. An alternative method to study isovector E2 resonances in nuclei, based on the radiative capture of fast neutrons, will be presented. Results from such experiments performed at the tandem accelerator laboratories in Los Alamos and Uppsala will be presented and discussed in terms of the direct-semidirect capture model. As a separate issue, the preparations being undertaken at Uppsala for studies of isovector excitations in nuclei by means of the (n,p) reaction will be described. A schematic lay-out of the experiment will be presented together with some relevant neutron beam parameters. Among isovector excitations to be studied by this method are the isovector monopole resonance and the Gamow-Teller resonance. 54 references, 6 figures, 1 table.

3873 Chiral asymmetry in nuclear beta decay. van Klinken, J. (Univ. of Groningen (Netherlands)). pp 369-388 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

Nuclear β decay can be instrumental to electroweak unification studies by observation of the degree of longitudinal polarization of β rays from allowed Fermi and from allowed Gamow-Teller decays. Possible deviations from maximality of this polarization bear on a fundamental question: is there a manifest left-right symmetry, indicated by right-handed currents and V+A admixture to a dominant V-A interaction? Discussed are absolute β^- and relative β^+ measurements. The β^- measurements are of long-standing age; the β^+ measurements are recent and not yet fully analyzed. A striking consequence of the polarization may be an intimate relation with the origin of life: can it be that the chirality of biomolecules is determined by the longitudinal polarization of β rays? 20 references, 9 figures.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 3395

3874 (AD-A—196877/5/XAB) Neutron multiplication in beryllium. Doctoral thesis. Hartley, R.S. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1988. 170p. (AFIT/CI/NR—88-59). NTIS, PC A08/MF A01.

Integral neutron multiplication experiments were performed using homogeneous spherical shells of beryllium metal of 4.6-, 6.99-, 7.87-, 9.38-, 13.8-, and 19.9-cm thickness. Neutron leakage, produced by Cf-252 and DT neutron sources placed in the center of the shells, were measured with a Bonner-sphere spectrometer system. The rate of DT neutron production was normalized using an associated particle system placed inside the target assembly, which was inserted into the shells via a reentrant hole. The neutron fluence was obtained by processing the room-returned and air-scattered corrected count-rate data with a Bonner-sphere-spectrum unfolding routine and a weighted Bonner-sphere technique. The neutron multiplication was obtained directly by comparing the normalized neutron-leakage fluence with and without beryllium present. The neutron-leakage spectra were calculated for each shell using the discrete ordinates codes ANISN and ONEDANT using ENDF/B-IV and ENDF/B-V respectively.

3875 **(CTA-IEAV-RP—001/88) BCG: a code for calculating pointwise neutron spectra and criticality in fast reactor cells.** Leite, S.B.; Caldeira, A.D.; Garcia, R.D.M. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Feb 1988. 64p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704171/JAW.

The BCG code for determining the space and energy neutron flux distribution and criticality of fast reactor cylindrical cells is presented. The code solves the unidimensional neutron transport equation together with interface current relations at each energy in an unionized grid prepared for the cell and at an arbitrary number of spatial zones. While the spatial resolution is user specified, the energy dependence of the flux distribution is resolved according to the degree of variation in the reconstructed total microscopic cross sections of the atomic species in the cell. Results for a defined sample problem illustrate the high resolution and accuracy that can be obtained with the code.

3876 (INIS-BR—1275, pp 31) **Elements of classical, self-consistent and non-linear x-ray diffraction theory I. A plane of dipoles as an unit of scattering.** Keller, W.A. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3877 (INIS-BR—1275, pp 32) **Elements of classical, self-consistent and non-linear X-ray diffraction theory II. The Bragg law redefined in an energy conserving mode.** Keller, W.A. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3878 **(JINR-R—3-88-48) Diffusion of ultracold neutrons through a branched neutron guide.** Golikov, V.V.; Ignatovich, V.K.; Nikitenko, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1988. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704867/JAW.

A theory of ultracold neutrons (UCN) diffusion a branched neutron guides is developed within the diffusion approximation. Experiments to test the theory are described. A comparison of experimental results with theoretical predictions points out to the necessity of account for the angular distribution of UCN in the neutron guide. 4 figs.

3879 **(MPE—190) Secondary electron emission of carbon foils at transmission of ions in the energy range from 40 to 500 keV.** Ritter, H.C. (Max Planck-Institut fuer Extraterrestrische Physik, Garching (Germany, F.R.)). Feb 1985. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88780124/JAW.

Secondary electron emission by bombarding carbon foils with ions in the energy range from 40 to 500 keV is measured. (BBOE).

6550 Medical Physics

REFER ALSO TO CITATION(S) 3458

3880 **(ENEA-RT-COMB—88-1) Total external dose equivalent and effective dose derived to the Piedmont population in the period 30 Apr 1986 - 22 Sep 1987.** Cortissone, C.; Giacomelli, R.; Spezzano, P.; Porzio, L. (ENEA, Saluggia (Italy). Centro Ricerche Energia; USL 45, Vercelli (Italy). Lab. Sanita' Pubblica). (ENEA, Rome (Italy)). 1988. 38p. (In Italian). NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE88704899/JAW.

Some dosimetric evaluations concerning the population of the Piemonte Region, obtained after the measurements made following the Chernobyl accident, are reported. The individual effective mean dose equivalent derived from the exposure and intake in the period April 30, 1986 - September 22, 1987, is about 0.50 mSv.

3881 **(IAEA-R—3745-F) Radon measurements in Austrian buildings and estimation of collective doses for the population. Final report for the period March 1984 - March 1987.** Steger, F. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz). (International Atomic Energy Agency, Vienna (Austria)). Jul 1988. 80p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704184/JAW.

Nuclear track etch detectors were used for the determination of radon and radon daughter levels in Austrian dwelling houses. A diffusion chamber, developed at Karlsruhe, FRG, was used to construct a passive radon detector. It consists of a plastic beaker covered with a glass fibre filter. It is shielded by a cover which has openings on the side so that air can diffuse through and on the top there is a mounted thermoluminescent detector card. The TLD dosimeter was used to determine beta and gamma radiation levels. A polycarbonate foil was placed at the bottom of the diffusion chamber which served as a detector for the alphas emitted by radon daughters. The dosimeters were exposed for a period of three months. The mean concentration of radon in all rooms in dwelling houses in Austria were clearly higher in winter than in summer time. This was interpreted as the effect of reduced ventilation rates in winter time. This effect of ventilation on radon concentration is more significant in living and sleeping rooms than in the cellar. Compared to all rooms in a dwelling house the level of radon concentration was distinctly higher in the cellar. Higher values of radon concentration were found in famous radon spa of Gastein and in the Waldviertel and in a landscape near the Czechoslovakian border. In Vienna a mean value for radon concentration in the living and sleeping rooms was found to be 47 bq/m/sup 3/ which corresponds to an estimated effective dose equivalent to the lung of 10.7 mSv per annum. The whole body effective dose equivalent was estimated to be 1.27 mSv per annum. These estimations were based on the radon equilibrium factor of 0.5. The exposure to radon at such concentration is estimated to cause 3-4% incidence of excess lung cancer in Vienna within the next 20 years. (Abstract Truncated)

3882 **(INIS-BR—1324) Abreu System - a dosimetric system to evaluate basic functioning parameters of roentgenography equipment.** Feital, J.C. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 25p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704783/JAW.

This work shows a system to evaluate the half-value thickness of X-ray bundle. This system consists in a card with an aluminium filter, thermoluminescent dosemeter of lithium fluoride and radiographics films.)C.G.C.).

3883 **(INIS-BR—1326) Control of the scattered radiation.** Farias, J.T. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 21p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704785/JAW.

The control of the scattered radiation based on the main factors that acts on its intensity are studied. Some principal methods for reduction the scattered radiation that get the film are also described, like decreasing the irradiated surface of the film, using of grid, using of air gap technic and the moving slits techniques. (C.G.C.).

3884 **(INIS-BR—1327) Quality control manual for oral radiology.** Peixoto, J.E.; Ferreira, R.S.; Bessa, S.O.; Domingues, C.; Gomes, C.A.; Oliveira, S.L.G.; Ortiz, J.A.P. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 16p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704786/JAW.

A quality control manual for oral radiology is showed. The X-ray equipment used for this activity is described, such as the X-

ray tube, collimator. The high tension in X-ray tube, the spectra, the quality and the quantity of radiation and the X-ray intensity are also analysed. (C.G.C.).

3885 **(INIS-BR—1328) Radioprotection inspection manual for odontologic X-rays equipment.** Almeida, C.D. de. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 14p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704787/JAW.

The inspection manual for odontologic X-ray, using films and thermoluminescent dosemeters are showed, decreasing the time of exposition by some recommendation. Some calculations are also cited, for decrease the exposure time, for filtrating the equipment and for a radiometric survey. (C.G.C.).

3886 **(INIS-BR—1331) Monte Carlo applied for calculation dose.** Peixoto, J.E. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 5p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704790/JAW.

The Monte Carlo method is showed for the calculation of absorbed dose. The trajectory of the photon is traced simulating sucessive interaction between the photon and the substance that consist the human body simulator. The energy deposition in each interaction of the simulator organ or tissue per photon is also calculated. (C.G.C.).

3887 **(INIS-BR—1342) Short and medium-term medical follow-up program for victims of the Goiania accident, Brazil: a proposal.** Oliveira, A.R. de; Brandao-Mello, C.E.; Farina, R. (NUCLEOS, Rio de Janeiro (Brazil). Area de Saude). (NUCLEOS, Rio de Janeiro (Brazil). Area de Saude; Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704800/JAW.

The medical surveillance of the individuals who supposedly received high radiation doses due to the breaking of Cesium-137 source from gamma radiation therapy apparatus, is presented. The study includes a serie of evaluations and procedures such as periodic clinical examinations, and diagnostic procedures. Among the special procedures unusual in routine medical practice, the radiochemical analysis of urine and feces, and the whole-body counting are mentioned, to evaluate the total and residual body burden of Cesium-137 in the organism. Following the acute phase of radiation effects on the organism, such examinations intend to detect, early, the functional or organic changes which may appear during the first years after exposure. (M.C.K.).

3888 **(INIS-BR—1343) General medical and related aspects of the Goiania accident, Brazil.** Oliveira, A.R. de; Valverde, N.J.L.; Brandao-Melo, C.E.; Hunt, J.G. (NUCLEOS, Rio de Janeiro (Brazil). Area de Saude; Furnas, Rio de Janeiro (Brazil); Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil); NUCLEI, Rio de Janeiro (Brazil)). (NUCLEOS, Rio de Janeiro (Brazil). Area de Saude; FURNAS, Rio de Janeiro (Brazil); Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil); NUCLEI, Rio de Janeiro (Brazil)). 1988. 32p. NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE88704915/JAW.

In a recent radiation accident occurred in the city of Goiania, central area of Brazil, approximately 250 people were exposed to a 137Cs source from a radiotherapy unit abandoned in a amedical clinic in that city. At least twelve patients showed some degree of bone marrow depression, from which eight developed the classical signs and symptoms of Acute radiation Syndrome (ARS). 28 people presented local radiation burns ranging from first to third degree. Around 100 people showed evidences of internal contamination due to the dissemination of the source powder. The authors describe the circumstances of the event, the first-aid measures taken at place, the criteria adopted during the triage of victims and the radiation protection procedures used during the management and treatment of the irradiated individuals.

3889 **(JINR—16-87-935) Physical-dosimetric measurements in the ROCUS-M gamma unit.** Wagner, R.; Jiroushek, P.; Kovarzh, I.; Novotny, J.; Zorin, V.P.; Klimov, O.L.; Molokanov, A.G.; Mitsyn, G.V. (Ceskoslovenska Akademie Ved, Prague. Ustav Radiologicke Dozimetrie). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 13p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704835/JAW.

The exposure radiation dose rate in the reference point and some other radiation parameters of ROCUS-M distant gamma apparatus for radiotherapy and radiobiological investigations. Two clinical dosimeters 27012 were calibrated with respect to primary standard of the Prague Institute of Radiation Dosimetry. The measured physicodosimetric characteristics of radiation source will be used for planning and carrying out medical-biological investigations. 4 refs.; 7 figs.; 6 tabs.

3890 **Microdosimetry and radiation protection.** Brackenbush, L.W. (Pacific Northwest Lab., Richland, WA (US)). pp 81-82 of Proceedings of the topical conference on theory and practices in radiation protection and shielding. Volumes 1-2. La Grange Park, IL; American Nuclear Society (1987). (CONF-870405—).

From Topical conference on theory and practice in radiation protection and shielding; Knoxville, TN, USA (22 Apr 1987).

The Pacific Northwest Laboratory has developed an instrument, the Total Dose Meter, to determine the dose equivalent from penetrating ionizing radiations in mixed radiation fields, such as neutrons and gamma rays. This device is intended to be used as an alarming personnel monitor to determine the total dose equivalent, and uses a single cylindrical tissue-equivalent proportional counter (TEPC) detector. The TEPC is operated at very low pressures so that it measures the energy deposition distribution in a tissue-like site only 1 micrometer in diameter. The present instrument uses algorithms to determine neutron quality factors using the currently accepted values. If the recommendations of ICRU-40 are adopted, the algorithms in the microprocessor can be changed to determine the new values of quality factor for neutrons and for photons.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 3212, 3235, 3285

3891 **(AD-A—196487/3/XAB) Adsorption of H_2 D_2 on Fe (100): kinetics and energetics. Interim report, 1 March 1986-28 February 1988.** Kurz, E.A.; Hudson, J.B. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 28 Feb 1988. 8p. (TR—4). NTIS, PC A02/MF A01.

The adsorption behavior of H_2 and D_2 have been studied on an Fe(110) single crystal surface using a combination of thermal energy atom scattering (TEAS) and angle resolved thermal desorption spectroscopy (ARTDS). TEAS has been used to monitor adlayer coverage during adsorption, desorption and at equilibrium over a range of constant temperatures; and during temperature programmed desorption. ARTDS has been used to measure the desorption flux as a function of surface polar angle during temperature programming following adsorption at low temperature. H_2 and D_2 adsorb directly, dissociatively, with an activation energy for adsorption of slightly less than 1 kcal/mol, and an initial sticking coefficient of about 0.1, independent of temperature.

3892 **(AD-A—196488/1/XAB) Reaction of hydrogen with oxygen on a polycrystalline iron surface. Interim report, 1 March 1986-28 February 1988.** Arbab, M.; Hudson, J.B. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 28 Feb 1988. 7p. (TR—5). NTIS, PC A02/MF A01.

The interaction between hydrogen and oxygen on a polycrystalline iron sample was studied using Auger electron spectroscopy (AES) and mass spectrometry. A hydrogen permeation method was used. The authors found that chemisorbed oxygen cannot be removed by reaction with adsorbed hydrogen, while oxygen incorporated into the near surface region of the bulk is ti-

trated rapidly, to leave a constant amount of (chemisorbed) oxygen on the surface, independent of reaction temperature. All results, including both the titration data obtained by AES and the water formation and desorption rates determined by mass spectroscopy, could be interpreted with an overall activation energy of 16.0 + 2.6 kcal/mole. Of this total energy, 8.5 + 0.4 kcal/mole was determined to be due to the kinetics of hydrogen permeation through the iron sample.

3893 **(AD-A—196489/9/XAB) Kinetics and mechanism of oxygen uptake on a polycrystalline iron surface. Interim report, 1 March 1986-28 February 1988.** Arbab, M.; Hudson, J.B. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 28 Feb 1988. 43p. (TR—6). NTIS, PC A03/MF A01.

The initial uptake of oxygen was studied on a clean, polycrystalline iron surface over the temperature range between 360 and 575 K, using a combination of Auger electron spectroscopy and mass spectrometry. An initial chemisorption period is followed in turn by a temperature-dependent linear-oxidation regime and a final period of decreasing oxidation rate. Chemisorption kinetics can be explained by an intrinsic molecular precursor mechanism. The linear oxidation period involves uptake into the near-surface bulk by a non-activated place exchange mechanism.

3894 **(AD-A—196490/7/XAB) Titration of oxygen on a polycrystalline iron surface by permeating hydrogen. Interim report, 1 March 1986-28 February 1988.** Arbab, M.; Hudson, J.B. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 28 Feb 1988. 48p. (TR—7). NTIS, PC A03/MF A01.

The interaction between oxygen and hydrogen on a clean polycrystalline iron surface was studied by Auger electron spectroscopy and mass spectrometry. To avoid having the reaction kinetics limited by the slow adsorption of hydrogen on the oxidized surface, hydrogen was supplied by permeation through the thin iron specimen. For oxygen coverages of more than one monolayer, this procedure resulted in the rapid titration of oxygen by the formation and desorption of water. In the temperature range of 475-625 K, the reaction path consists of the initial formation of OH from coadsorbed oxygen and hydrogen, followed by the disproportionation of two hydroxyl species to form H_2O. An overall activation energy of 7-8 Kcal/mole was measured for the above reaction sequence. Oxygen in coverages of less than one monolayer could not be removed by hydrogenation, in agreement with a previous study on an Fe(100) single crystal substrate. This present study shows that this apparent stability of the chemisorbed oxygen is not due to the kinetics of hydrogen adsorption.

3895 **(ENEA-RT-TIB—88-6) Absorption lineshape of F/sub A/ centers in alkali halides.** Baldacchini, G.; Giovenale, E.; De Matteis, F.; Scacco, A.; Somma, F.; Grassano, U.M. (ENEA, Frascati (Italy). Centro Ricerche Energia; Rome Univ. I (Italy). Dipt. di Fisica; Rome Univ. II (Italy). Dipt. di Fisica). (ENEA, Rome (Italy)). 1988. 23p. NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE88704906/JAW.

The line shape of the absorption bands of F/sub A/ centers in alkali halides have been studied for the first time. The new method used for this investigation is based on the determination of the overlap between the F/sub A1/ and F/sub A2/ bands from luminescence measurements. The experimental results have been compared with calculated values deduced from the theoretical F/sub A/ bands of different shapes. For both F/sub A/(I) centers in KCl:Na/sup +/ and F/sub A/(II) centers in KCl:Li/sup +/ and RbCl:Li/sup +/ the absorption lineshape at low temperature is much closer to a sum of two Lorentzian curves than that of two Gaussian or Poissonian bands. This results shows an unexpected difference with the F centers, whose absorption lineshape is known to be Poissonian at the same temperatures.

3896 **(EUR—11231) On the diffusion process of irradiation-induced point defects in the stress field of a moving dislocation.** Steinbach, E. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755646/JAW.

The cellular model of a dislocation is used for an investigation of the time-dependent diffusion process of irradiation-induced point defects interacting with the stress field of a moving dislocation. An analytic solution is given taking into account the elastic interaction due to the first-order size effect and the stress-induced interaction, the kinematic interaction due to the dislocation motion as well as the presence of secondary neutral sinks. The results for the space and time-dependent point defect concentration, represented in terms of Mathieu-Bessel and Mathieu-Hankel functions, emphasize the influence of the parameters which have been taken into consideration. Proceeding from these solutions, formulae for the diffusion flux reaching unit length of the dislocation, which plays an important role with regard to void swelling and irradiation-induced creep, are derived.

3897 **(FRNC-R—271) Laboratory of irradiated solids.** (Ecole Polytechnique, 91 - Palaiseau (France); CEA, 75 - Paris (France)). Jan 1988. 29p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755464/JAW.

After a brief recall of results obtained these last twenty years researches in progress are described. Are studied: Solid state physics, particle-matter interactions, crystal defects, nuclear materials. A list of main projects is given.

3898 **(IC—88/145) Analysis of the structure of the surface local density of states at the Fermi level.** Baquero, R.; Quiroga, L.; Camacho, A. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704704/JAW.

We use a tight-binding description of the bands of bulk vanadium to set a surface band structure. We show that the knowledge of the s-d charge transfer in the surface layer is very important to be able to reproduce the ferromagnetic behaviour of the (100) vanadium surface. We use the surface Stoner criterium of Allan to determine acceptable values for the s-d charge transfer. There is no full agreement between theory and experiment on the magnetic properties of (100)-vanadium at present. (author). 15 refs, 1 fig.

3899 **(IC—88/164) LO-phonon confinement and polaron effect in a quantum-well.** Comas, F.; Trallero-Giner, C.; Riera, R. (International Centre for Theoretical Physics, Trieste (Italy); Havana Univ. (Cuba). Dept. of Theoretical Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704717/JAW.

Polaronic corrections are calculated considering electron coupling with confined LO-phonons in a Quantum-Well (QW). Electron-LO-phonon Hamiltonian for confined electron-phonon system in a QW is taken from a previous work. Electron self energy is calculated using the standard perturbation theory treatment for the weak-coupling polaron assuming parabolic energy band structure and T = O K. Screening effects are included along the lines of static Thomas-Fermi approximation. Comparison with different experimental works is made and acceptable agreement is achieved. We also compare other theoretical works on the subject. (author). 18 refs, 5 figs, 1 tab.

3900 **(IC—88/165) Multiple LO-phonon Raman scattering and hot excitons.** Trallero-Giner, C.; Riera, R. (International Centre for Theoretical Physics, Trieste (Italy); Havana Univ. (Cuba). Faculty of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704718/JAW.

A theory is developed which describes multiphonon resonance Raman scattering (MPSR) processes in polar semiconductors

when the primary radiation frequency w/sub l/ is above the fundamental absorption region. A general formula for the MPRS cross-section based in the exciton distribution function is presented as a function of w/sub l/, the indirect creation and annihilation probabilities, the exciton lifetime, and the transition probabilities between different exciton states. The different role of the hot-exciton-transitions and their main contribution to the cross-section is investigated. It is shown that the cross-section depends greatly on the ratio of the electron and hole effective masses. Using that and earlier theoretical results for the exciton scattering, the scattering lines showing intensity alternation in InI and InBr (M. Yoshida et al. J. Phys. Soc. of Japan, 54, 2754 (1985)) are explained if the electron and hole effective masses are nearly equal. The final result corresponds to a cascade model of exciton relaxation where the main transitions are between 2p and 2s exciton states. The approximate formula for the MPRS cross-section is given. (author). 17 refs, 4 figs.

3901 **(IC—88/176) Magnetoelastic effects in the Ising model on the Union Jack lattice.** Pawlicki, P. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704726/JAW.

The Ising model with a uniform strain is solved exactly on the Union Jack lattice. It is shown that the difference between the anti-ferromagnetic and ferromagnetic phases becomes non-trivial in the presence of the deformation. It is found that the nearest neighbour correlation function can change its sign during the transition to the disordered phase. (author). 7 refs, 2 figs.

3902 **(IC—88/185) Transfer matrices for multilayer structures.** Baquero, R. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704730/JAW.

We consider four of the transfer matrices defined to deal with multilayer structures. We deduce algorithms to calculate them numerically, in a simple and neat way. We illustrate their application to semi-infinite systems using SGFM formulae. These algorithms are of fast convergence and allow a calculation of bulk-, surface- and inner-layers band structure in good agreement with much more sophisticated calculations. Supermatrices, interfaces and multilayer structures can be calculated in this way with a small computational effort. (author). 10 refs.

3903 **(IC—88/193) Dynamics of simple defect clusters in alkaline earth fluorides.** Haridasan, T.M.; Sekar, P. (International Centre for Theoretical Physics, Trieste (Italy); Madurai Kamaraj Univ., Madurai (India). School of Energy Sciences). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704733/JAW.

The effect of isolated F/sup -/vacancies and interstitials on the Dobye Waller Factors of their neighbours is studied. The perturbation due to the introduction of the defect is calculated using the scattering theory. The critical jump amplitude in the diffusion process is fitted to reproduce the experimental migration energy. The diffusion coefficient for the vacancy mechanism is estimated to be larger than that for the interstitialcy mechanism in the superionic region. (author). 21 refs, 8 figs, 2 tabs.

3904 **(IC—88/202) Electronic structure of VH, NbH and TaH in the β-phase.** Vargas, P. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704736/JAW.

Calculations of the DOS (Density of States) for the three mono-hydrides of V nB and Ta in the orthorhombic β-phase were performed using the LMTO method. In all three systems the hydrogen induced states below the Fermi level split in two maxima as a consequence of the H-H interactions. This fact agrees with photoemission experiments. We report also the calculated Bulk Modulus and equilibrium lattice parameters. This is the first time that a hand structure calculation is reported for the β-VH and β-TaH systems. (author). 15 refs, 3 figs.

3905 **(IC—88/221) On thermopower calculations with temperature dependent electron energies.** Butcher, P.N.; Zvyagin, L.P. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704744/JAW.

It is argued that the thermoeletric transport coefficients in a coupled electron-phonon system depend on the interaction of phonons with a heat bath. When the phonon mean free path is short, the temperature dependent energy levels may be introduced in the Boltzmann equation which yields the usual formulae for the thermopower with temperature dependent energies inserted. For weak phonon-heat bath interaction and strong electron-phonon interaction the transport equation is obtained for new quasiparticles and the energy current includes the transport of the electron-phonon energies carried along by a quasiparticle. (author). 13 refs.

3906 **(IC—88/228) Relaxation property of the fractional Brownian particle.** Wang Litan; Lung, C.W. (Academia Sinica, Shenyang, LN (China). Inst. of Metal Research). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704746/JAW.

Dynamic susceptibility of a diffusion system associated with the fractional Brownian motion (fBm) was examined for the fractal property of the Non-Debye relaxation process. The comparisons between fBm and other approaches were made. Anomalous diffusion and the Non-Debye relaxation processes were discussed with this approach. (author). 8 refs, 1 fig.

3907 **(IC—88/240) Vacancy formation energies in close-packed crystals correlated with melting temperature via thermodynamics and liquid structure.** Rashid, R.I.M.A.; March, N.H. (International Centre for Theoretical Physics, Trieste (Italy); Oxford Univ. (UK). Dept. of Theoretical Chemistry). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704748/JAW.

In earlier work, the vacancy formation energy E/sub v/ in close-packed crystals, in units of the thermal energy k/sub B/T/sub m/ at the melting temperature T/sub m/, has been connected with compressibility and specific heats, plus terms dependent on the liquid structure at T/sub m/. Here, this connection has been examined quantitatively for (a) the insulating condensed rare gases Ne, Ar and Kr, and (b) a variety of close-packed metals. For case (a), E/sub v//k/sub B/T/sub m/ can be calculated directly from thermodynamic data to obtain agreement with experiment for Ar and Kr, though not for Ne. A 'residual' contribution is estimated for Ar and Kr from diffraction and computer experiments on the density dependence of the liquid pair correlation function and is shown to be very small. Agreement is less impressive for case (b) for the eight close-packed metals for which all data required is known, the thermodynamic formula giving an average value E/sub v//k/sub B/T/sub m/=7.8+-1.1 whereas experiment yields 9.4+-1.8. However, for the body-centred cubic alkalis the thermodynamic average value of 4.5+-0.5 is much lower than the experimental value 11.5+-2.0 consistent with the known role of ionic relaxation round the vacancy in such open structures. (author). 16 refs, 2 tabs.

3908 **(IC—88/249) Soliton excitations in deformable solids.** Pushkarov, D.I.; Primatarowa, M.T. (International Centre for Theoretical Physics, Trieste (Italy); Bylgarska Akademiya na Naukite, Sofia. Inst. po Fizika na Tvyrdoto Tyalo). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704753/JAW.

Nonlinear effects caused by the interaction of quasiparticle (exciton, defecton etc.) with phonons in deformable solids are considered. In the one-dimensional case two types of solitary excitations are shown to appear situated at the bottom and the top of the quasiparticle energy band, respectively. The treatment is based on the general nonlinear dynamics theory of deformable crystals with quasiparticle excitations. (author). 10 refs.

3909 **(IC—88/256) Bond particle model for semiconductor melts and its application to liquid structure germanium.** Ferrante, A.; Tosi, M.P. (International School of Advanced Studies, Trieste (Italy)). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704759/JAW.

A simple type of liquid state model is proposed to describe on a primitive level the melt of an elemental group IV semiconductor as a mixture of atoms and bond particles. The latter, on increase of a coupling strength parameter becomes increasingly localized between pairs of atoms up to local tetrahedral coordination of atoms by bond particles. Angular interatomic correlations are built into the model as bond particle localization grows, even though the bare interactions between the components of the liquid are formally described solely in terms of central pair potentials. The model is solved for liquid structure by standard integral equation techniques of liquid state theory and by Monte Carlo simulation, for values of the parameters which are appropriate to liquid germanium down to strongly supercooled states. The calculated liquid structure is compared with the results of diffraction experiments on liquid germanium near freezing and discussed in relation to diffraction data on amorphous germanium. The model suggests simple melting criteria for elemental and polar semiconductors, which are empirically verified. (author). 25 refs, 9 figs, 3 tabs.

3910 **(IC—88/270) Role of the order parameter in a liquid crystalline phase transition.** Ponce, T.C. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704763/JAW.

The question of what the role is of the long range orientational order parameter, S, in a liquid crystalline phase transition in particular, the nematic to isotropic transition, is considered here. An analytic calculation of S as a function of temperature T for a Lebwohl-Lasher orientational potential and semi-analytical calculation of S for a Maier-Saupe potential are presented. Also, the distribution function $f(\theta)$ is found to have the form of a Dirac-Delta function in the perfectly ordered state for which $S=1$. (author). 10 refs, 2 figs.

3911 **(IC—88/271) Molecular orientational re-ordering and the transformation of a Landau second order phase transition to first order in a nematic liquid crystal.** Ponce, T.C. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704764/JAW.

We consider the nature of the nematic to isotropic phase transition in terms of the molecular orientational re-ordering, expressed by the variation of the order parameter, s, in the light of Landau's theory of second order phase transition. Then, we show how the de Gennes modification to the Landau thermodynamic potential converts the transition to first order which is in better agreement with the experimental observations. (author). 9 refs, 2 figs, 1 tab.

3912 **(INIS-BR—1275) Proceedings of the 10. Workshop of the Brazilian Society of Crystallography and Symposium on Crystallography and New Materials.** (Sociedade Brasileira de Cristalografia, Sao Paulo, SP (Brazil)). 1988. 36p. (In Portuguese). (CONF-8807125—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW.

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

Studies on material structure and properties using crystallographic techniques, such as X-ray diffraction and neutron diffraction are presented. (M.C.K.).

3913 (INIS-BR—1275, pp 10) **New technique for studying interfaces: the X-ray multiple scattering.** Cardoso, L.P.; Morelhao, S.L.; Sasaki, J.M.; Carvalho, M.M.G. de. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3914 (INIS-BR—1275, pp 19) **Study of the step of cholesteric liquid crystal in function of micellae shape anisotropy.** Lopes, M.C.V.; Figueiredo Neto, A.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3915 (INIS-BR—1275, pp 20) **Study of sodium lauryl sulfate system in water by small angle X-ray scattering.** Itri, R.; Amaral, L.Q. do. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3916 (INIS-BR—1275, pp 22) **Structural evolution of porous silicon gels.** Craievich, A.F.; Lours, T.; Zarzycki, J.; Aegerter, M.A. (Laboratorio Nacional de Luz Sincrotron, Campinas (Brazil); Centre National de La Recherche Scientifique, Montpellier (France). Lab. de Science des Materiaux Vitreux; Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3917 (INIS-BR—1275, pp 23) **Porous structure of alumina gels.** Franceschini, D.; Craievich, A.F. (Petroflex, Duque de Caxias (Brazil); Laboratorio Nacional de Luz Sincroton, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3918 (INIS-BR—1275, pp 25) **Study on porous structure of Pinus elliottii coal with small angle x-ray scattering.** Sousa, J.C. de; Torrianni, I.L.; Luengo, C.A. (Universidade Estadual de Maringa (Brazil); Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3919 (INIS-BR—1275, pp 26) **Granular model for carbonaceous materials.** Emmerich, F.G.; Torrianni, I.L.; Luengo, C.A. (Espirito Santo Univ., Vitoria (Brazil). Dept. de Fisica e Quimica; Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3920 (INIS-BR—1275, pp 29) **Characterization of polycrystalline materials determining medium size of crystallites by r-ray diffraction.** Martinez, L.G.; Riella, H.G.; Imakuma, K. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3921 (INIS-BR—1275, pp 30) **Measurement of selenium anomalous dispersion by differential interferometric method.** Rodrigues, A.R.D.; Mazzaro, I. (Laboratorio Nacional de Luz Sincrotron, Campinas (Brazil); Parana Univ., Curitiba (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704348/JAW. (CONF-8807125—).

From 10. workshop of the Brazilian Society of Crystallography and symposium on crystallography and new materials; Campinas, Brazil (18 Jul 1988).

3922 **(JINR-R—7-88-73) Blocking and channeling effects for recoil nuclei in a silicon monocrystal.** Karamyan, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1988. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704874/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

By using /sup 27/Al, /sup 40/Ar and /sup 129/Xe ion beams the interaction of the elastic and inelastic recoil nuclei with a silicon single crystal is investigated. With a variation of the ion energy and detecting angle, reflexes of the crystallographic directions are observed in the forms of both blocking minima and channeling maxima. The conditions under which the recoil nuclei emitted in elastic scattering rechannel after degrading in a crystal medium are clarified. The effect of the decay duration of inelastic scattering products on the blocking minimum profile is found and the effective lifetime is estimated. 9 refs.; 4 figs.

3923 **(LA-UR—88-3522) Positron annihilation in $TiBe_2$.** Manuel, A.A.; Hoffmann, L.; Singh, A.K.; Jarlborg, T.; Peter, M.; Smith, J.L.; Fisk, Z.; Pecora, L.M.; Ehrlich, A.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-8808122—10). NTIS, PC A02/MF A01. Order Number DE89002054/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

We report positron annihilation measurements on $TiBe_2$. Calculations using LMTO band structure method are also presented. The good agreement with the experimental data leads to the conclusion that the unusual magnetic properties of this compound can be well explained in terms of its electronic structure. A reconstruction of the electron-positron momentum distribution from calculated and measured 2D-ACPAR is discussed. 10 refs., 3 figs.

3924 **(LBL—26091) Electronic behavior of highly correlated metals.** Reich, A. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 120p. NTIS, PC A06/MF A01. Order Number DE89002492/JAW.

This thesis addresses the question of the strongly interacting many-body problem: that is, systems where the interparticle correlations are so strong as to defy perturbative approaches. These subtle correlations occur in narrow band materials, such as the lanthanides and actinides, wherein the f-electrons are so localized that a variety of new phenomena, including intermediate-valence and heavy-fermionic behavior, may occur. As well, one has the alloying problem, where local interactions are paramount in determining the overall behavior. The technique employed in dealing with these systems is the Small Cluster method, wherein the full many-body Hamiltonian for a small grouping of atoms, coupled with periodic boundary conditions, is solved exactly. This is tantamount to solving a bulk crystal at the high points of symmetry in the Brillouin Zone. The mathematical overhead is further reduced by employing the full space group and spin symmetries. By its very nature, the Small Cluster method is well able to handle short-range interactions, as well as the combinatorial complexity of the many-body problem, on an equal footing. The nature of long-range order and phase transition behavior cannot be incorporated, but sometimes clues as to their origin can be discerned. The calculations presented include: a two-band Anderson model for an intermediate-valence system, wherein photoemission and fluctuation behavior is examined; a single-band Hubbard model for a ternary alloy system, such as copper-silver-gold; and a Hubbard model for a heavy- fermion system, wherein Fermi surface, transport, magnetic and superconducting properties are discussed. 148 refs., 31 figs., 24 tabs.

3925 **(PNL-SA—15895) Alloy work functions and energy distribution curves.** Gordon, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 41p. (CONF-8810201—1). NTIS, PC A03/MF A01. Order Number DE89001743/JAW.

From 9. international symposium on exoelectrons and applications; Wroclaw, Poland (3 Oct 1988).

In an effort to extend results previously obtained on the correlation of changes of energy distribution curves with surface work function changes in a Re-1%Pd alloy, the present work reports results obtained with alloys of Re-1%Au and Re-1%Pt. The effect of surface segregation of the minor constituent on the work function of the alloy surface was recorded. Correlation between work function of the alloy surface was recorded. Correlation between work function changes and the energy distribution curves for secondary electrons produced by He-I radiation was sought. Results suggest that observed electron populations in the band structure of the Re-1%Pt alloy are consistent with observed work function changes. Surface impurities of S and Ca in the case of the Re-1%Au sample prevent unambiguous conclusions regarding correlation between changes in population of alloy bands and work function changes. 15 refs., 22 figs.

3926 **(PNL-SA—15997) Surface structure determination of the cleavage faces of CdSe via low-energy positron diffraction.** Duke, C.B.; Lessor, D.E.; Horsky, T.N.; Brandes, G.; Canter, K.F.; Lippel, P.H.; Paton, A.; Wang, Y.R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 17p. (CONF-881002—19). NTIS, PC A03/MF A01. Order Number DE89001993/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Low energy positron diffraction intensities were measured for positron beams from CdSe(1010) and fourteen beams for CdSe(1120). These were compared with calculated intensities for bond-length- conserving relaxed surface structures for both surfaces. Using an R-factor methodology the best-fit structures were obtained for these surfaces corresponding to local planar tilt angles of $\omega = 15 +-5\{degree\}$ for CdSe(1010) and $\omega = 27 +-7\{degree\}$ for CdSe(1120). Both results are in excellent correspondence withe predicted structures based on tight-binding total-energy minimization calculations. 21 refs., 5 figs., 2 tabs.

3927 **(UCRL—98998) Applications of ion implantation for modifying the interactions between metals and hydrogen gas.** Musket, R.G. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 15p. (CONF-881151—28). NTIS, PC A03/MF A01. Order Number DE89002877/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Ion implantations into metals have been shown recently to either reduce or enhance interactions with gaseous hydrogen. Published studies concerned with modifications of these interactions are reviewed and discussed in terms of the mechanisms postulated to explain the observed changes. The interactions are hydrogenation, hydrogen permeation, and hydrogen embrittlement. In particular, the results of the reviewed studies are: uranium hydriding suppressed by implantation of oxygen and carbon; hydrogen gettered in iron and nickel using implantation of titanium; hydriding of titanium catalyzed by implanted palladium; tritium permeation of 304L stainless steel reduced using selective oxidation of implanted aluminum; and hydrogen attack of a low-alloy steel accelerated by implantation of helium. These studies revealed ion implantation to be

an effective method for modifying the interactions of hydrogen gas with [illegible]s. 9 refs., 4 figs.

3928 (ZfK—584, pp 38) **Model investigations on nitrogen implantation in silicon.** Sobeslavsky, E.; Wollschlaeger, K. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3929 (ZfK—584, pp 39) **Modelling of the oxygen redistribution during formation of buried SiO/sub 2/ layers by high dose oxygen implantation.** Jaeger, H.U. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3930 (ZfK—584, pp 40) **On the choice of the electronic stopping formula for range profile calculations in the MeV region.** Posselt, M.; Skorupa, W.; Beyer, A.; Markgraf, W. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Technische Univ., Karl-Marx-Stadt (German Democratic Republic). Sektion Physik/Elektronische Bauelemente). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

3931 (ZfK—584, pp 41) **Influence of the energy transport by recoils on energy-loss profiles.** Posselt, M. Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

6561 Superconductivity

REFER ALSO TO CITATION(S) 3177, 3199, 3200, 3201, 3202, 3203, 3209, 3924

3932 **(AD-A—196969/0/XAB) Coupled even-parity superconducting states. Technical report.** Sahu, D.; Langner, A.; George, T.F. (State Univ. of New York, Buffalo (USA). Dept. of Chemistry). Jun 1988. 30p. (UBUFFALO/DC—88/TR-70). NTIS, PC A03/MF A01.

In situations involving two successive superconducting transitions or in situations in which one superconducting transition induces a secondary superconducting state, the nature of the coupling between the states is of interest. Examples of such coupling include heavy fermion systems and possibly the recently discovered high T/sub c/ superconductors. Symmetry principles are used to enumerate the Ginzburg-Landau free energies associated with the coupling between s and d wave superconducting states in the square planar, cubic, tetragonal, orthorhombic and hexagonal crystal classes.

3933 **(IC—88/167) Self-similarity correlations in high-temperature superconductivity.** Arvay, Z. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704720/JAW.

Thermally induced structural phase transitions produce self-similar quasi-2D chain-like structure in the CuO/sub 2/ planes. Self-similar, scale invariant wave functions-solutions of the scale invariant Hamiltonian-represent states of long range correlations. These intrinsically correlated states can be observed as carriers of super-current. The conformal invariant string theory is proposed as a first approximation to describe the mechanism of high-temperature superconductivity. (author) 8 refs.

3934 **(IC—88/174) Effective spinon-spinon and holon-holon interactions in RVB models of high-T/sub c/ superconductivity.** Nguyen Van Hieu. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704724/JAW.

The interaction between the bosonic excitations as well as between the fermionic ones in the RVB systems with the (extended) Hubbard Hamiltonians were studied by means of the slave boson technique and the perturbation theory. The corresponding effective Hamiltonians have been found. It was shown, in particular, that in the RVB system with two interpenetrating sublattices there exists the effective attraction between two holons of different kinds as well as between two spinons of different kinds in the singlet state. (author). 27 refs.

3935 **(IC—88/177) Correlation between electronegativity and superconductivity.** Asokamani, R.; Manjula, R. (International Centre for Theoretical Physics, Trieste (Italy); College of Engineering, Madras (India). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704727/JAW.

This paper brings out one of the striking features exhibited by all oxide superconductors. It is found that irrespective of the values of T/sub c/, the average electronegativity, x of all the oxide superconductors lies between 2.5 and 2.65. This is in contrast to the elemental superconductors whose x values lie in a broad range from 1.3 to 1.9. Further, the pressures required to drive some of the elemental metals to become superconductors have been calculated on the basis of their electronegativity values. The pressures so obtained agree very well with the experimental observations and those calculated on the basis of band theory. The average electronegativity of A-15 and Cheverel phase superconductors are also given. Based on the concept of electronegativity the other oxide systems which are likely to become superconductors have been suggested. (author). 33 refs, 1 fig., 4 tabs.

3936 **(IC—88/181) Does spin density wave-like antiferromagnetic ordering coexist with extended s-wave pairing in the nearly half-filled quasi two-dimensional Hubbard model.** Wrobel, P. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704729/JAW.

It has been shown that the spin-density wave instability does not coexist with s-like anisotropic superconductivity in the molecular field approach to the nearly half-filled two-dimensional Hubbard model. The phase diagram of the interplay of normal state, spin density wave, d-wave and extended s-wave superconducting orderings has been constructed. The possibility of the first order transition from the normal state and the superconducting state to the SDW-phase has been discussed. (author). 14 refs, 2 figs.

3937 **(IC—88/201) New effect on the dependence of T/sub c/ on the number of Cu-O layers in the non-rare-earth ceramic superconductors.** Chela-Flores, J.; Martin, P.; Rodriguez-Nunez, J.J. (International Centre for Theoretical Physics, Trieste (Italy); Universidad Simon Bolivar, Caracas (Venezuela). Dept. de Fisica; Universidad Simon Bolivar, Caracas (Venezuela). Dept. de Electronica). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704735/JAW.

We argue from the experimental evidence that the superconductivity in the non-rare-earth compounds is confined to two inequivalent layers of Cu-O planes where electron pairing occurs. This conjecture leads us to a set of phenomenological equations in terms of two order parameters that correctly describe the characteristic lengths of the copper oxide ceramics. The formalism developed indicates that samples with a larger number of Cu-O layers may have higher transition temperatures. The formalism suggests that in a multilayered Cu-O compound increments of T/sub c/ as a function of the doping parameter will be more pronounced the larger the number of layers. (author). 12 refs.

3938 (IC—88/230) Effect of RVB flux configuration on the superconducting state. Baskaran, G.; Tosatti, E.; Yu Lu. (International Centre for Theoretical Physics. Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704747/JAW.

The RVB state is a singlet quantum liquid which can support periodic or fluid-like quantum circulation around the elementary plaquette in two dimensions. In the s+id phase there is a half flux quanta of circulation in every elementary plaquette. We show that the holons in the presence of this lattice of circulation have a two-valley structure, as opposed to "s" or "d" states, which have a single valley. Using an effective holon Hamiltonian, we study the mean-field properties of the two-valley holon condensate, and compare its energy with the single valley case. A transition from the "d" to the "s+id" state is predicted with increasing hole concentration for sufficiently large Hubbard U. Some speculations are offered about the general case of a fluid-like distribution of flux quanta. (author). 27 refs, 1 fig.

3939 (IC—88/277) Mercereau effect as a guide to the theory of high-T/sub c/ superconductivity in rare earth oxide ceramics. Chela-Flores, J.; Martin, P.; Rodriguez-Nunez, J. (International Centre for Theoretical Physics, Trieste (Italy); Universidad Simon Bolivar, Caracas (Venezuela). Dept. de Fisica; Universidad Simon Bolivar, Caracas (Venezuela). Dept. de Electronica). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704767/JAW.

We emphasize the importance of performing definite experiments on quantum interferometers, basing our work on a phenomenological theory of high-T/sub c/ superconductivity co-existing with antiferromagnetism. The theory satisfies all the general requirements of previous models, including minimal gauge invariant coupling terms. Yet, since no doping-dependent displacements are implied in the Mercereau diffraction pattern, this phenomenological approach underlines the urgency of performing new experiments in order to guide the theory. (author). 21 refs, 1 fig.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 3688, 3693

3940 (AD-A—196422/0/XAB) Computational structure of the N-body problem. Memorandum report. Katzenelson, J. (Massachusetts Inst. of Tech., Cambridge (USA). Artificial Intelligence Lab.). Apr 1988. 55p. (AI-M—1042). NTIS, PC A04/MF A01.

This work considers tree algorithms for the N-body problem where the number of particles is on the order of a million. The main concern is the organization and performance of these computations on parallel computers. The work introduces a formulation of the N-body problem as a set of recursive equations based on a few elementary functions. It is shown that both the algorithm of Barnes-Hut and that of Greengard-Rokhlin satisfy these equations using different elementary functions. The recursive formulation leads directly to a computational structure in the form of a pyramid-like graph, where each vertex is a process, and each arc a communication link. The pyramid is mapped to three different processor configurations: (1) A pyramid of processors corresponding to the processes pyramid graph; (2) A hypercube of processors, e.g., a connection-machine like architecture. (3) A rather small array, e.g., 2 x 2 x 2, of processors faster then the ones consider in (1) and (2) above. The main conclusion is that simulations of this size can be performed on any of the three architectures in reasonable time. 20 seconds per time step is the estimate for a million equally distributed particles using the Greengard-Rokhlin algorithm on the CM-2 connection machine. The smaller array of processors is quite competitive in performance.

3941 (AD-A—196903/9/XAB) O(N) algorithm for three-dimensional N-body simulations. Master's thesis. Zhao, F. (Massachusetts Inst. of Tech., Cambridge (USA). Artificial Intelligence Lab.). Oct 1987. 74p. (AI-TR—995). NTIS, PC A04/MF A01.

The author presents an algorithm that computes the gravitational potentials and forces on N point-masses interacting in three-dimensional space. The algorithm, based on analytical techniques developed by Rokhlin and Greengard, runs in order N time. In contrast to other fast N-body methods such as tree codes, which only approximate the interaction potentials and forces, this method is exactly computes the potentials and forces to within any prespecified tolerance up to machine precision. Presented is an implementation of the algorithm for a sequential machine. The author numerically verifies the algorithm and compares its speed with that of an O(sq N) direct-force computation. He also describes a parallel version of the algorithm that runs on the Connection Machine in order O(log N) time. This document compares experimental results with those of the sequential implementation and discusses how to minimize communication overhead on the parallel machine.

3942 (DOE/ER/13761—7) Nonlinear optics with broad-band lasers: Final report for period April 15, 1988--August 31, 1988. Raymer, M.G. (Rochester Univ., NY (USA). Inst. of Optics). May 1988. Contract FG02-87ER13761. 7p. NTIS, PC A02/MF A01. Order Number DE89002728/JAW.

This project has focused on a number of related topics in nonlinear optics, unified by the theme of temporal fluctuations in the light field emitted by broad-band lasers. The following new results were obtained: the shot-to-shot statistics of multimode, pulsed dye lasers were measured, and cross correlations between mode energies were observed and explained; evidence for phase locking between the modes was also obtained; a new technique was demonstrated for smoothing the intensity fluctuations of the pulses emitted by multimode dye lasers; the influences of laser bandwidth in the stimulated Raman scattering process were studied experimentally and theoretically; a theoretical study was carried out to predict the effects of laser bandwidth in the spectrum of light scattered by atomic vapors; and fluctuation dynamics and instability behavior of multimode continuous-wave dye lasers were studied experimentally and theoretically. The mechanism for mode intensity fluctuations was found to be four-wave mixing, which is a deterministic process, not noise driven. 9 refs.

3943 (IC—87/378) On some weighted norm inequalities for a certain class of integral operators. Imoru, C.O. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704692/JAW.

The objective of this paper is to provide a unified treatment of the results of Andersen and Heinig on some weighted norm inequalities for a certain class of integral operators. These results are extended to higher dimensions, with special cases highlighted. (author). 3 refs.

3944 (IC—88/97) New Weyl groups for A/sub 1//sup (1)/ and characters of singular highest weight modules. Dobrev, V.K. (International Centre for Theoretical Physics, Trieste (Italy)). May 1988. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704698/JAW.

We consider singular Verma modules over A/sub 1//sup (1)/, i.e Verma modules for which the central charge is equal to minus the dual Coxeter number. We calculate the characters of certain factor modules of these Verma modules. In one class of cases we are able to prove that these factor modules are actually the irreducible highest modules for those highest weights. We introduce new Weyl groups which are infinitely generated abelian groups and are proper subgroups or isomorphic between themselves. Using these Weyl groups we can rewrite the character formulae obtained in the paper in the form of the classical Weyl character formula for the finite-dimensional irreducible representations L of semisimple Lie algebras (resp. Weyl-Kac character formula for the integrable highest weight modules over affine Kac-Moody algebras) so that the new Weyl groups play the role of the usual Weyl group (resp. affine Weyl group). (author). 17 refs.

3945 **(IC—88/128) Positive energy bound states at higher partial waves.** Awin, A.M.; Kremid, A.M. (International Centre for Theoretical Physics, Trieste (Italy); Al-Fateh Univ., Tripoli (Libya). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704700/JAW.

Positive energy bound states (PEBS) at higher order (than the 0/sup th/) partial waves have been studied using a particular form factor. The phase shifts have been calculated in detail for the cases of l=0,1,2. It is found that for a rank-1 separable potential the expected behaviour, at the PEBS energy, is obtained. Finally, some important conclusions have been drawn regarding some problems previously studied in connection with s-wave positive energy bound states. (author). 8 refs, 3 figs.

3946 **(IC—88/129) Weyl group for the Virasoro and N=1 super-Virasoro algebras.** Dobrev, V.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704701/JAW.

We introduce a Weyl group for the highest weight modules over the Virasoro algebra and the Neveu-Schwarz and Ramond superalgebras. Using this group we rewrite the character formulae for the irreducible highest weight modules over these algebras in the form of the classical Weyl character formula for the finite-dimensional irreducible representations of semi-simple Lie algebras (and also of the Weyl-Kac character formula for the integrable highest weight modules over affine Kac-Moody algebras). This is the same group we introduced recently in order to rewrite in a similar manner the characters of the singular highest weight modules over the affine Kac-Moody algebra A/sub 1//sup (1)/. (author). 32 refs, 2 tabs.

3947 **(IC—88/143) Geometric characterization of a class of modular representations.** Assadi, A.H. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704702/JAW.

The purpose of this paper is to prove the following characterization of the invertible elements of the Green ring of a p-elementary Abelian group. Let G=(Z/p)/sup m/, and let k be an algebraically closed field of characteristic p. Suppose M is a finitely generated indecomposable kG-module and let N be a kG-module such that Mx/sub k/N is stably isomorphic to k (with the trivial G-action). Then M is kG-isomorphic to a Heller module Ω/sup n/(k), n is an element of Z. In particular, we recover a theorem of E. Dade chemical bondDchemical bond on the characterization of endo-trivial modules as a corollary. If End/sub k/(M) approx.= k + Free and M is indecomposable, then M approx.= Ω/sup n/(k) for some n is an element of Z. (author). 10 refs.

3948 **(IC—88/162) Nonlinear de Broglie waves and the relation between relativistic and nonrelativistic solitons.** Barut, A.O.; Baby, B.V. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704716/JAW.

It is shown that the well-known envelope soliton and kink solutions of the nonlinear Schroedinger equation are the nonrelativistic limit of the corresponding solutions of the nonlinear Klein-Gordon equation. 34 refs.

3949 **(IC—88/178) Quantum dynamical semigroups and the theory of quantum measurements.** Ghirardi, G.C.; Rimini, A.; Weber, T. (International Centre for Theoretical Physics, Trieste (Italy); Pavia Univ. (Italy). Dipt. di Fisica Nucleare e Teorica; Trieste Univ. (Italy). Dipt. di Fisica Teorica). (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704728/JAW.

The possible use of non-Hamiltonian type quantum evolution equations to find a solution to the problem of Wave Packet Reduction is discussed. A particular class of equations usually referred to as Quantum Dynamical Semigroup is considered. 6 refs.

3950 **(IC—88/188) Asymptotic behaviour of almost non expansive sequences in a Hilbert space.** Djafari Rouhani, B. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704732/JAW.

The results for non expansive sequences are generalized to almost non expansive sequences in a Hilbert space, and using this notion a direct proof of a result of H. Bresis and F.E. Browder is given. (author). 25 refs.

3951 **(IC—88/208) CP-violation and Einstein's locality reconsidered.** Ghirardi, G.C. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704737/JAW.

A critical reconsideration of the arguments put forward by A. Datta, D. Home and A. Raychaudhuri in two recent papers is presented. All crucial points of their analysis are examined and it is shown that their conclusions are not appropriate. (author). 18 refs.

3952 **(IC—88/215) Generalization of the test theory of relativity to noninertial frames.** Abolghasem, G.H.; Khajehpour, M.R.H.; Mansouri, R. (Sharif Univ. of Technology, Teheran (Iran)). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704740/JAW.

We present a generalized test theory of special relativity, using a noninertial frame. Within the framework of the special theory of relativity the transport- and Einstein-synchronizations are equivalent on a rigidly rotating disk. But in any theory with a preferred frame such an equivalence does not hold. The time difference resulting from the two synchronization procedures is a measurable quantity within the reach of existing clock systems on the earth. The final result contains a term which depends on the angular velocity of the rotating system, and hence measures an absolute effect. This term is of crucial importance in our test theory of the special relativity. (author). 13 refs.

3953 **(IC—88/222) Hilbert space structure on Banach algebras.** Mohammad, N.; Thaheem, A.B. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704745/JAW.

In this note we define an inner product on "reduced" Banach *-algebras via a measure on the set of positive functionals. It is shown here that the resultant inner product space is a topological algebra and also a completeness condition is obtained. (author). 9 refs.

3954 **(IC—88/241) Factorization of the relativistic Pauli equation in the presence of a gravitational field.** Melek, M. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704749/JAW.

Attention is called to a possible solution to the problem of the ambiguity in the numerical coefficient of the correction term (h/2π R) that occurs in the Klein-Gordon and relativistic Pauli equations in the presence of a gravitational field. This solution is based on the possibility of factorizing the relativistic Pauli equation for the propagator of the spin 1/2 particle, defined by a path integral, to obtain the Dirac equation in the presence of a gravitational field. (author). 6 refs.

3955 **(IC—88/260) Future null infinity of Robertson-Walker spacetimes.** Moreschi, O.M. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704761/JAW.

The future null infinity for all non-contracting Robertson-Walker space time is studied systematically. A theorem is proved which establishes the expected relation between the nature of J/sup +/ and the appearance or absence of cosmic event horizons. (author). 7 refs, 1 tab.

3956 **(IC—88/284) Diff(S/sup 1/)/SL(2,R) and Teichmueller space.** Nag, S.; Verjovsky, A. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704768/JAW.

It is shown that the unique homogeneous Kaehler metric carried by M=Diff(S/sup 1/)/SL(2,R) induces the Weil-Petersson metric on the Teichmueller space. This is via our identification of M as a holomorphic submanifold of universal Teichmueller space T(1). The identification was obtained simply by noting that every diffeomorphism of S/sup 1/ is a quasisymmetric homeomorphism. Our computations allow us also to prove that every T(G), G any infinite Fuchsian group, projects out of M transversely. This last assertion is related to the "fractal" nature of G-invariant quasicircles. (author). 12 refs.

3957 **(ITEF—24(1988)) Installation with magnetic suspension of test bodies for measurement of small forces. Verification of equivalence of inertial and gravitational mass. Discussion of the method.** Kalebin, S.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 17p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704810/JAW.

Torsion installation with magnetic suspension of test bodies for detection of small forces is considered. Installation application for verification of equivalence of inertial and gravitational mass in the case of test body incidence on the Earth (Etvesh experiment) and in the case of their incidene on the Sun (Dicke experiment) is discussed. The total mass of test bodies, produced in the form of cylinders with 3 cm radius, equals 50 kg (one lead body and one copper body); beam radius of test bodies equals 3 cm (the cylinders are tight against one another); ferrite cylinder with 3 cm radius and 10 cm height is used for their suspension in magnetic field. Effect of thermal noise and electromagnetic force disturbances on measurement results is considered. Conducted calculations show that suggested installation enables to improve the accuracy of verifying mentioned equivalence at least by one order and upwards. This suggests that such installation is a matter of interest for experiments on small force detection. 15 refs.; 1 fig.

3958 **(JINR-E—2-87-890) On the SSQM and nonlinear equations.** Hruby, J.; Makhan'kov, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704840/JAW.

The method for obtaining the superpartner potential in the supersymmetric quantum mechanics (SSQM) is discussed in connection with the nonlinear equations and the reflectionless potentials. The correspondence between a new class of the soliton solutions to the U(N) nonlinear Schroedinger equation is obtained via application of SSQM and those known earlier are also discussed. 16 refs.

3959 **(JINR-E—2-88-54) Equations of motion for the new D=10 N=1 supergravity-Yang-Mills theory.** Vashakidze, Sh.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704843/JAW.

An on-shell superfield formulation of the dual (type IB) tendimensional N=1 supergravity coupled to Yang-Mills theory is presented. The coupling is completely specified in superspace by A-tensor supercurrent which, at the same time, takes into account all superstring corrections in the slope parameter expansion. The complete set of equations of motion is derived. 9 refs.

3960 **(JINR-E—2-88-80) Continuous representation for spin 1/2, quantum probability theory and Bell paradox.** Polubarinov, I.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704846/JAW.

Quantum mechanics of spin 1/2 is translated into a classical language namely into a continuous representation ("coherent state representation"). This permits us to compare the quantum probability theory with the classical one. The Bell paradox is analysed. It is shown that the quantum correlator of two spins 1/2 in the singlet state turns out to be equal 9 times a classical one, and therefore. It is illegitimate to put it in the Bell inequality. The true quantum inequality is absolutely unrestrictive. In the continuous representation, equations of motion take a classical form similar to the Liouville equation in classical mechanics. Their solutions can be expressed via characteristics, subjected to equations relative to the Hamiton ones. However quantum theory still differs from classical one in choice of probability densities and in construction of correlators, of other quantities, of an analog of the Markov property, etc. These quantities and relations can be converted into their classical form in the framework of the quantum mechanics as well, but only in terms of modified "probability densities", which cannot be possible definite. 32 refs.

3961 **(JINR-R—2-87-916) On a behaviour of the density of states of extended particles at high energies.** Makhaldiani, N.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704862/JAW.

The asymptotic formula for the density of states of Hamiltonian systems is obtained. The quantum statistical description on the system at high energies is reduced to the classical one. An exactly solvable model with highest possible temperature is introduced. The behaviour of the density of states of extended particles, hadrons, nuclei, relativistic strings and memebranes is considered. 36 refs.

3962 **(JINR-R—2-88-55) Capture and confinement of solitons in a nonlinear integrable system.** Mel'nikov, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704865/JAW.

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The system is considered which is described by the Kortweg-de Vries equation with the source satisfying the stationary Schroedinger equation. The solutions are found in this system which describe solitons coming from infinity and then captured in the periodic oscillatory regime. 6 refs.

3963 **(JINR-R—2-88-61) And still: do fast-moving scales contract or elongate?.** Strel'tsov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704866/JAW.

Traditional definition of the length of fast moving scale and the concept of relativistic length (CRL) are considered from the point of view of condition of relativistic covariance. It is shown that the last consept satisfies this condition, whereas the traditional definition is in contrast with it ("synchronous length" is not a 4-vector). It is noted that following from CRL "elongation formula" corresponds to the growth of formation length of fast hadrons with energy. It is difficult to adjust the last fact with the traditional opinion of the tendency to zero of longitudinal dimensions of relativistic particles. It is stressed that additional account made of the influence of Earth's motion on the velocity of light propagation along transverse interferometer arm in the known inperpretation of the Michelson-Morley experiment leads to the "elongation formula" for a longitudinal arm. 11 refs.; 1 figs.

3964 **(JINR-R—4-87-929) Local adiabatic representation in the few-body quantum scattering problem.** Vinitskij, S.I.; Dubovik, V.M.; Markovskij, B.L.; Kuperin, Yu.A.; Makarov, K.A.; Pavlov, B.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Leningradskij Gosudarstvennyj Univ. (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704870/JAW.

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The adiabatic approximation in the few-body problem is considered as a local realisation of the global adiabatic representation for the Schroedinger and Faddeev equations. The problem is

formulated in terms of the Hilbert bundles. Basic geometric objects, connections, curvature, hermitian metric, appear as the dynamical ones. Their nontrivial nature depends on the spectral projections applied when reducing to a multichannel effective system. Some simple nontrivial illustrations confirm the validity of the proposed scheme. 12 refs.; 1 fig.

3965 **(LA-UR—88-3139) Low dimensional sigma models.** Zakrzewski, W.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8808145—4). NTIS, PC A03. Order Number DE89000362/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

We discuss classical solutions of U(N) σ models in two dimensions. We show how from these solutions we can construct solutions of the U(N) σ model with the Wess--Zumino term (with an arbitrary coefficient). We discuss briefly various properties of these solutions. Next we consider the O(3) σ model in 2 + 1 dimensions and describe the preliminary results of some numerical work in which we studied the time evolution of some of the previously discussed two dimensional structures (instantons and anti-instantons) under suitable assumptions about their initial values. 9 refs., 6 figs.

3966 **Causality in the Coulomb gauge: A direct proof.** Gardiner, C.W.; Drummond, P.D. (University of Waikato, Hamilton, New Zealand). *Physical Review [Section] A: General Physics;* **38**: No. 9, 4897-4898(1 Nov 1988).

A direct calculation of causality behavior in Coulomb-gauge solutions to the Maxwell equations is given, with an arbitrary time-dependent source.

3967 **Physics of uniformly accelerated relativistic motion.** Sheldon, E. (Univ. of Lowell, MA (USA)). pp 389-407 of Coherent effects in highly excited nuclei: Proceedings. Wilhelmi, Z.; Szeflinska, G. (eds.). New York, NY; Harwood Academic Publishers (1987). (CONF-8609190—).

From 18. Mikolajki summer school on nuclear physics; Mikolajki, Poland (1 Sep 1986).

An overview is given of some unforeseen consequences of incorporating acceleration into the formalism of special relativity in an extended treatment that relates phenomena in a noninertial frame of reference Σ (i.e., a system moving relativistically with constant proper acceleration in the x = zeta-direction) to their observation in an inertial restframe S. The modifications to the velocity of light, time rates and the Doppler effect, aberration and the temporal Terrell effect are described and discussed. 23 references.

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REFER ALSO TO CITATION(S) 2905, 4026

3968 **(AD-A—196561/5/XAB) Excitation of instabilities due to an external field. Final technical report, 10 February 1986-31 August 1987.** Nishikawa, K.I. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). 18 Apr 1988. 8p. NTIS, PC A02/MF A01.

Ion-cyclotron like modes in a magnetoplasma with a transverse inhomogeneous electric field are simulated. A new mechanism can destabilize electrostatic waves in the presence of a nonuniform electric field perpendicular to the uniform ambient magnetic field. When the electric field is nonuniform, it is possible for a finite region to contain negative wave energy surrounded by regions of positive-wave energy. The ion-cyclotron instability is important to both space and laboratory plasma. This new mechanism is investigated for an instability by means of simulations in the presence of a nonuniform electric field perpendicular to the uniform magnetic field associated with a density gradient. A two-dimensional electrostatic code was used that retains the full dynamics of the ions in three dimensional velocity space. Electrons are treated by the guiding-center approximation in the perpendicular direction while the parallel motion is treated exactly. Nonlinear phenomena such as diffusion and coalescence of vortices are investigated. In the linear stage, smaller vortices are generated and larger vortices with the lower frequencies are dominant in the nonlinear stage. In the nonlinear stage, ions diffuse strongly due to large-scale vortices.

3969 **(ANL/FPP/TM—229) EDDYNET: A user's manual.** Turner, L.R.; Gibbard, S. (Argonne National Lab., IL (USA). Fusion Power Program). Sep 1988. Contract W-31109-ENG-38. 70p. NTIS, PC A04/MF A01. Order Number TI89002466/JAW.

This user's guide provides a description of the EDDYNET code, which is used to model transient eddy currents in conducting shells. Subroutines and functions are described, and the input variables and file format are explained. Examples are given of input and output files from the program. A description is given of special features of the program, including temperature diffusion, field and flux from circular rings, and current-angular deflection coupling. 13 refs., 6 figs.

3970 **(CLM-R—286) Turbulent correlations and anomalous transport in tokamaks. Part 1. General theory.** Thyagaraja, A.; Haas, F.A. (UKAEA Culham Lab., Abingdon). Aug 1988. 74p. H.M. Stationery Office, London, price Pound 12.00.

A comprehensive account is given of the general method of calculating turbulent correlations and transport properties in tokamaks when a single fluctuation spectrum (say electrostatic potential) is specified. Subject to rather weak restrictions, the specified spectral function is shown to determine (under quasi-neutral conditions neglecting trapped particle and anisotropic pressure effects) all other fluctuation spectra and transport properties.

3971 **(CONF-880534—13) Plasma performance in JET: Achievements and projections.** Gibson, A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03. Order Number DE89002219/JAW.

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

An account is given of recent experimental advances on JET, especially as they relate to fusion performance. Scaling relations are used to identify the critical parameters which need to be optimized to secure the best fusion performance. Finally the established best performance of JET is used as a base to project the performance to be expected in future D-T operation. 13 refs., 20 figs., 6 tabs.

3972 **(CONF-880534—14) High power Ion Cyclotron Resonance Heating [ICRH] in JET.** Jacquinot, J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01. Order Number DE89002218/JAW.

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

Ion Cyclotron Resonance Heating (ICRH) powers of up to 17 MW have been coupled to JET limiter plasmas. The plasma stored energy has reached 7 MJ with 13 MW of RF in 5 MA discharges with Z/sub eff/ = 2. When I/sub p//B/sub {phi}/ = 1 MA/T the stored energy can be 50% greater than the Goldston L mode scaling. This is due to transient stabilisation of sawteeth (up to 3 s) and to a significant energy content in the minority particles accelerated by RF (up to 30% of the total stored energy). Central temperatures of T/sub e/ - 11 keV and T/sub i/ = 8 keV have been reached with RF alone. (He^3)D fusion experiments have given a 60 kW fusion yield (fusion rate of 2 {times} 10^{16} s/sup {minus}1/ in the form of energetic fast particles (14.7 MeV(H), 3.6 MeV(He^4)) in agreement with modelling. When transposing the same calculation to a (D)T scenario, Q is predicted to be between 0.12 and 0.8 using plasma parameters already achieved. For the first time, a peaked density profile generated by pellet injection could be reheated and sustained by ICRF for 1.2 s. Electron heat transport in the central region is reduced by a factor 2 to 3. The fusion product n/sub io/{tau}/sub E/T/sub io/ reaches 2.2 {times} 10^{20} m/sup {minus}3/{center←dot}s{center←dot}kev in 3 MA discharges which is a factor of 2.3 times larger than with normal density profile. 18 refs., 13 figs., 3 tabs.

3973 **(CONF-881031—28) Tokamak confinement projections and performance goals.** Uckan, N.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE89002212/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

One key quantity to be determined in the design of burning-plasma devices (CIT, ITER, reactors, etc.) is the level of plasma current (I) required to meet the desired plasma performance goals (ignition, high Q, etc.) and device objectives (fusion power, wall loading, current drive power, etc.). It is shown that these goals and objectives can be expressed in terms of the "figure-of-merit" parameter IA/sup alpha//R/sup x/[{approximately}f(LB/sup y/], where A is the aspect ratio, R is the major radius, L(= R, a) is the characteristic length, B is the toroidal magnetic field on axis, and the exponents α {approximately} 1 +- 0.5 and x {approximately} 0-0.5 (y {approximately} 1-2) depend on the confinement assumptions and operational limits. To reach ignition or high Q, the main goal is to optimize IA/sup alpha//R/sup x/, subject to other engineering design constraints. In a CIT-like device (with R {approximately} 2 m, κ {approximately} 2, q/sub psi/ $\geqq$ 3), the ignition requirements is I(A/3)/sup alpha/ {approximately} 9-15 MA for "enhanced" L-mode (H-mode) confinement scaling expressions; an ITER-like device (with R {approximately} 5-6 m, κ {approximately} 2, q/sub psi/ $\geqq$ 3) would require I(A/3)/sup alpha/ {approximately} 15-25 MA. These requirements are embodied in the present CIT (with I {approximately} 11 MA, A {approximately 3.25) and ITER (with I {approximately} 18-22, A {approximately} 3.1-2.6) designs. 12 refs., 1 fig., 3 tabs.

3974 **(CONF-881031—29) Ignition and steady-state current drive capability of INTOR plasma.** Uckan, N.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01. Order Number DE89002211/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The confinement capability of the INTOR plasma for achieving ignition and noninductively driven, Q>5 steady-state operation has been assessed for various energy confinement scaling laws and current drive schemes by using a global power balance model. Plasma operation contours are used to illustrate the boundaries of the operating regimes in density-temperature (n-T) space. Results of the analysis indicate a very restricted capability (if any) for ignition and a limited flexibility in driven modes of operation in the INTOR (8-MA) design. Nearly a factor of two increase in plasma current (through stronger plasma shaping) could improve the feasibility of ignition in INTOR. 14 refs., 4 figs., 3 tabs.

3975 **(CONF-8805213—1) IAEA specialists' meeting on carbon and oxygen collision data for fusion plasma research.** Phaneuf, R.A.; Defrance, P.; Griffin, D.C.; Hahn, Y.; Pindzola, M.S.; Roszman, L.; Wiese, W. (Oak Ridge National Lab., TN (USA); Louvain Univ., Louvain-la-Neuve (Belgium). Inst. de Physique; Rollins Coll., Winter Park, FL (USA); Connecticut Univ., Storrs (USA); Auburn Univ., AL (USA); National Inst. of Standards and Technology, Gaithersburg, MD (USA)). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01. Order Number DE89001524/JAW.

From IAEA specialists' meeting on carbon and oxygen collision data for fusion plasma research; Vienna, Austria (12 May 1988).

A brief overview is given of the status of the carbon and oxygen atomic data base for electron-impact excitation, ionization and recombination, and for spectroscopic data. Deficiencies for fusion plasma research applications are identified. Additional data are most critically needed for dielectronic and radiative recombination. 10 refs., 1 fig., 3 tabs.

3976 **(CONF-8809174—1) CIT equilibrium modeling.** Strickler, D.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03. Order Number DE89001697/JAW.

From PF systems workshop; Princeton, NJ, USA (15 Sep 1988).

This paper discusses: HEQ improvements; divertor coil current distributions; expanded radius plasma; limiter coil currents; and shape control studies. This paper is viewgraph form. (LSP)

3977 **(DOE/ER/52092—11) [Multimegawatt Gyrotron Program]: Quarterly status report, 1 July--30 September 1988.** (Naval Research Lab., Washington, DC (USA)). 1988. Contract AI05-83ER52092. 2p. NTIS, PC A02/MF A01. Order Number DE89002499/JAW.

This paper briefly discusses the use of a quasi-optical gyrotron to examine issues of single moded operation and radiation transport in a confined plasma. (LSP)

3978 **(DOE/ER/53212—128) Nonlinear behavior of the reversed field pinch with nonideal boundary conditions.** Ho, Y.L.; Prager, S.C.; Schnack, D.D. (Wisconsin Univ., Madison (USA). Plasma Physics Research). Aug 1988. Contract FG02-85ER53212. 15p. NTIS, PC A03/MF A01. Order Number DE89002830/JAW.

The effect of a resistive boundary and/or a distant conducting wall on a reversed field pinch is investigated with a three-dimensional magnetohydrodynamics code. Fluctuations rise with increasing distance between the conducting wall and the plasma. The enhanced fluctuation induced v {times} b electric field primarily opposes toroidal current; hence loop voltage must increase to sustain the current. 13 refs., 4 figs.

3979 **(ENEA-RT-TIB—87-19) Coherent radiation generation in 7.9 to 8.7 μm and 11 to 14 μm regions by rotational Raman scattering in Deuterium.** Bernardini, M.; D'Amato, F.; Giorgi, M.; Marchetti, S. (ENEA, Frascati (Italy). Centro Ricerche Energia; Consiglio Nazionale delle Ricerche, Pisa (Italy). Lab. di Fisica Atomica e Moleculare). (ENEA, Rome (Italy)). 1987. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE88704904/JAW.

Stimulated rotational Raman scattering of CO/sub 2/ laser radiation in ortho-D/sub 2/ provides a high-power coherent source in the infrared region from 11 to 14 μm. A peak output energy of $\cong$1 J has been obtained for a pump energy of 4.0 J. Threshold energies have been compared with those of para-H/sub 2/ measured in the same apparatus and experimental scaling factors are discussed. 17 refs.

3980 **(IAE—4554/8) Physical concepts and structure of the TVD tokamak.** Bortnikov, A.V.; Brevnov, N.N.; Gerasimov, S.N. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 31p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704687/JAW.

The TDV tokamak is designed for the investigation of plasma with a highly-elongated cross-section, k$\leqq$4. The equilibrium of plasma is ensured by the currents through the excitation, equilibrium and shape windings. Another three windings are provided to control the position and shape of plasma filament. The stability of plasma is maintained by a system of passive loops placed in the vacuum chamber. The results of the TVD equilibrium modeling are presented. The plasma filament stability against vertical displacement and the stability of the cross-section shape are discussed. The MHD stability of the equilibrium configurations has been calculated numerically to determine the minimum possible values of q at the plasma boundary and the limiting values of β. 54 refs.; 21 figs.; 7 tabs.

3981 **(IAE—4597/7) Estimations of effect of locally-trapped particles on electron energy losses in the T-7, T-10 and T-15 devices.** Merezhkin, V.G.; Mukhovatov, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704688/JAW.

The calculated data on the ripple of toroidal magnetic field $\delta(R)$ and values for the parameter $(\Delta/2)$/sup 3/2/xsin/sup 2/Θ in devices T-7, T-10 and T-15 are given (Θ is the relative depth of

local magnetic wells on r-radius magnetic surface). The results of numerical simulation of the plasma ECR heating in these devices are also listed, which were obtained taking into account losses with locally trapped particles for the region of frequent collisions. These losses are shown to become significant in T-10 at an electron temperature T/sub e/(0)>5-6 keV, and in tokamak T-7 - at T/sub e/(0)>10 keV. In tokamak T-15 electron losses of energy with locally trapped particles should be less than losses with toroidally trapped particles. 11 refs.; 5 figs.

3982 **(IAEA-CN—50/C-1-2) Initial experimental results from the ATF [Advanced Toroidal Facility] torsatron.** Saltmarsh, M.J.; Anderson, F.S.B.; Bell, G.L.; Bell, J.D.; Bigelow, T.S.; Carter, M.D.; Colchin, R.J.; Crume, E.C.; Dunlap, J.L.; Dyer, G.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 13p. (CONF-881015—25). NTIS, PC A03/MF A01. Order Number DE89002197/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

This paper reports on the results obtained in the initial operating period of the ATF torsatron. Detailed flux surface measurements show large islands in the vacuum magnetic fields. The cause and a means of correction have been identified. There is evidence of narrow temperature profiles and sensitivity to the magnetic configuration, which may reflect serious degradation of confinement in the outer regions of the plasma due to the observed island structure. Essentially currentless plasmas have been produced, using second harmonic electron cyclotron heating, with global properties (T/sub e0/ {approximately} 800 eV, {bar n}/sub e/ {approximately} 8 x 10^{18} m^{-3}) suitable for neutral beam injection. With 1.5 MW of neutral beam power, stored energies up to 7 kJ have been measured, corresponding to a central β {approx←gt} 2%. Throughout the beam heating phase, impurity radiation rises, and the plasma undergoes thermal collapse before the end of the beam pulse. The performance during beam injection is significantly improved by using partial chromium gettering of the vacuum vessel. 11 refs., 5 figs.

3983 **(IAEA-CN—50/C-I-5-1) Equilibrium and stability studies for low-aspect-ratio stellarator configurations.** Garcia, L.; Alejaldre, C.; Fraguas, A.L.; Guasp, J.; Varias, A.; Carreras, B.A.; Dominguez, N.; Lynch, V.E. (Oak Ridge National Lab., TN (USA); International Atomic Energy Agency, Vienna (Austria)). 1988. Contract AC05-84OR21400. 10p. (CONF-881015—18). NTIS, PC A02/MF A01. Order Number DE89000453/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

We use an average method based on vacuum flux coordinates to study the equilibrium and local stability (Mercier criterion) of low-aspect-ratio stellarator configurations. The results of these studies agree well with three-dimensional (3-D) calculations for the equilibria of both planar and helical magnetic axis configurations. The local stability criterion is a finer test of the equilibrium calculations, and the values obtained for the different terms using the average method and full 3-D calculations are close. This method permits the study of low-aspect-ratio helical axis configurations and the evaluation of the 3-D Mercier stability criterion, since the geodesic curvature term can be computed more accurately than before. 11 refs., 3 figs.

3984 **(INIS-BR—1205) Pre-ionization and spectroscopic diagnostic of plasma generated and confined by magnetic fields.** Honda, R.Y. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1980. 108p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704776/JAW.

A θ-pinch system has been constructed with pre-heating devices with a total energy of 2 kJ. During this experiment a He Plasma was studied using the following three different diagnostics. a) Magnetic Probes b) Visible Spectroscopy using the Optical Multichannel Analyser - OMA c) Image Converter Camera. The experimental results have been checked with existing theoretical models. The electrical characteristics of the system were determined with the magnetic probe. The Doppler and Stark broadening effects of the λ/sub o/ = 4686 (angstrom) (HeII) have been used to determine the ionic temperature and electronic density respectively. The time evolution of these parameters was obtained using the OMA. The dynamics of the plasma were observed by high speed photography. Instabilities in the plasma columm have been observed. Good agreement between the experimental and theoretical values was obtained.

3985 **(INIS-BR—1320) Effects of the finite pressure of plasma on internal kink mode.** Oliveira, G.M.G. de. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1980. 108p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704780/JAW.

The objective of this work is to study the stability of the Internal Kink and Central Kink modes in ideal MHD cylindrical plasma due to the pressure variations and the different current profiles. It was used the σ Euler equation derived by Goedbloed and Sakanaka. Its analysis is based on the boundary layer method, where the effects due to the plasma inertia are only considered in a boundary layer in the neighborhood of the surface where the perturbation is parallel to the field lines. For the internal Kink mode a numerical analysis is also done by integrating the Euler equation. It was calculated the growth rate of the two modes for the different pressure ans current profiles. It was verified that for both, the Internal Kink and Central Kink modes, the growth rate becomes larger as the derivative of these profiles increases. However, for the Internal Kink mode, one obtains a reduction of up to 50% in the growth rate calculated by Rosenbluth et al. For the Central Kink mode, one notices that the growth rate is proportional to β of the plasma and to the derivatives of the pressure and current.

3986 **(IPP—5/22) Propagation and absorption of electromagnetic waves for ICRF heating in Tokamak plasmas.** Kruecken, T. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik). Aug 1988. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755583/JAW.

We have simulated ICRF heating experiments in Tokamak plasmas. The model takes into account finite Larmor radius effects and kinetic damping in fully toroidal geometry. The wave equation for the electromagnetic field is then a linear partial integro-differential equation. To separate dissipative terms from kinetic flux terms in the power balance associated with the wave equation in a plasma with non-vanishing temperatures we derive a new expression for the local power absorption in arbitrary geometry. A one-dimensional code which is intended to be incorporated in a ray-tracing package to model the behaviour in the vicinity of a resonant layer, i.e. mode conversion and dissipation, is presented. The main part of this report is the description of a global code which solves the wave equation in full Tokamak geometry. It is capable to simulate mode conversion to ion Bernstein waves as well as ion cyclotron damping at the fundamental and second harmonic resonance. Electron magnetic pumping and Landau damping have also been included.

3987 **(ITEF—28(1988)) Effect of weak SHF-heating on the ion recombination in an expanding laser plasma.** Erema, Yu.N.; Latyshev, S.V.; Shumshurov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704811/JAW.

Study of the effect of different factors on dynamics of recombination processes taking place in a dispersive laser plasma at the distances of 0.01-10 m from the target is actual at present due to development of laser sources of high-charged heavy ions. It is shown experimentally that weak SHF-heating decreases ion recombination in the remote range of the dispersive laser plasma. Theoretical substantiation of the observed phenomenon is given. The ion component of laser plasma is investigated at the distance of 3.2 m from the target by means of the collector and time-of-flight mass-spectrometric diagnostics. 2-5-fold increase up to 1 keV Pb/sup +3/-Pb/sup +5/ ion quantity was discovered. 4 refs.; 2 figs.

3988 **(ITEF—39(1988)) Noncylindrical radiative Z-pinch at motion stage.** Gerusov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704815/JAW.

Numerical solution of two-dimensional magnetohydrodynamic equations in Γ, ZETA plane which describe motion stage of noncylindrical radiative Z-pinch is realised. It compares with numerical solution of one-dimensional cylindrically-symmetric magnetohydrodynamic equations. It is found that influence of plasma loss on the compression time and on the value of plasma parameters in the sheat is sufficiently small. The role of short-wave disturbances on the shape of boundary is considered. 14 refs.; 5 figs.

3989 **(JET-R—88-10) JET pump limiter.** Sonnenberg, K.; Deksnis, E.; Shaw, R.; Watson, R.; Groessmann, D.; Watkins, J.; Koski, J.; Reiter, D. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking; Sandia National Labs., Albuquerque, NM (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755550/JAW.

JET plans to install two pump limiter modules which can be used for belt-limiter, inner-wall and X-point discharges and, also, for 1-2s as the main limiter. A design is presented which is compatible with two diagnostic systems, and which allows partial removal of the pump limiter to provide access for remote-handling operations. The high heat-flux components are initially cooled during a pulse. Heat is removed between discharges by radiation and pressure contacts to a water-cooled support structure. The pumping edge will be made of annealed pyrolytic graphite. Exhaust efficiency has been estimated, for a 1-d edge model, using a Monte-Carlo calculation of neutral gas transport. When the pump limiter is operated together with other wall components we expect an efficiency of ≅ 5% (2.5 x 10/sup 21/ part/s). As a main limiter the efficiency increases to about 10%.

3990 **(OEFZS—4441) Plasma theory.** Kamelander, G. (Oesterreichisches Forschungszemtrum Seibersdorf G.m.b.H. Inst. fuer Energie- und Anlagentechnik). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1988. 219p. (In German). (EA—314/88). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88704891/JAW.

A series of lectures on plasma theory with the main headings: introduction; charged particles moving in em fields; the liquid model; transport phenomena in the plasma; wave propagation in plasmas; plasma instabilities. 57 figs. (qui).

3991 **(TRITA-PFU—87-10) Large Larmor radius effects on electrostatic fluid motion in a magnetized plasma.** Lehnert, B. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research). Oct 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755140/JAW.

For a magnetized plasma the dynamic problems of large Larmor radius (LLR) effects are classified with respect to the types of adopted initial perturbations. In addition, the special example of LLR effects on electrostatic fluid motion is considered more in detail. The analysis of such a type of motion includes the limiting cases of MHD behaviour, and of a large Debye distance leading to free streaming. An outline is further presented of the general solution which includes the feedback of the electric field perturbation on particle dynamics. The results of the present analysis, as well as those obtained from a number of earlier treated simple LLR problems, include a time dependence of the macroscopic field quantities which cannot be expressed in the simple form exp (iωt), where ω is a complex frequency with scalar real and imaginary parts. Consequently, LLR effects cannot be treated accurately in terms of a simplified kinetic approach for which the time dependence of the perturbed electric and magnetic fields is from the beginning assumed to have such a form. Instead the inverse Laplace transform can be applied, and the time dependence be treated in terms of the Laplace operator.

3992 **(UCRL—97462) Design of a far infrared interferometer diagnostic support structure.** Brooksby, C.A.; Rice, B.W.; Peebles, W.A. (Lawrence Livermore National Lab., CA (USA)). Oct 1987. Contract W-7405-ENG-48. 6p. (CONF-871007—128). NTIS, PC A03. Order Number DE89002283/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The Far Infrared Interferometer (FIR) diagnostic will operate in the 119 to 400 micron range to measure the plasma electron density on the Microwave Tokamak Experiment (MTX) being set up at LLNL. This diagnostic is a multi-channel system which incorporates a long elliptically shaped beam that passes through the plasma and is imaged onto an array of 14 detectors that are located on a table above the machine. The reference beam is brought around the machine and mixed with the plasma beam onto the detectors. The density is measured by a phase shift between these beams and is, therefore, very sensitive to path length changes between the two beam paths due to motion of the support structure. The design goal for allowable phase shifts caused by changes in the path length due to structure movement is 1/50th of a wavelength (2.4 to 8 microns). The structure needs to maintain this stability during the 0.5 second plasma shot. The structure is approximately 5 meters tall to support the optics table above the machine. In order to reduce the structure motion to the required level the forces acting on it were evaluated. The forces evaluated were eddy currents from the pulsed electromagnetic fields, the ambient ground motion, and the floor movement as the magnets are pulsed. The designs for similar diagnostic interferometers on other tokamaks were also reviewed to evaluate the forces and motions that might cause such small deflections in the support structure. Our structure is somewhat unique in that it is designed for operation in relatively large pulsed magnetic fields (100 to 7000 gauss) arising from the air core transformer of MTX. The design chosen incorporates a very rigid structure with high resistive and non-conductive materials. The choice of materials selected is discussed with reference to their response to expected forces. 14 refs., 10 figs.

3993 **(UCRL—98675) Induction-linac based free-electron laser amplifier for fusion applications.** Jong, R.A.; Stone, R.R. (Lawrence Livermore National Lab., CA (USA)). 1 Aug 1988. Contract W-7405-ENG-48. 26p. (CONF-8808146—2). NTIS, PC A03/MF A01. Order Number DE89001923/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

We describe an induction-linac based free-electron laser amplifier design for producing multi-megawatt levels of microwave power for electron cyclotron resonance heating of tokamak fusion devices such as the Compact Ignition Tokamak or the International Thermonuclear Experimental Reactor. The wiggler design strategy incorporates a tapering algorithm suitable for FEL systems with moderate space charge effects and minimizes spontaneous noise growth at frequencies below the fundamental, while enhancing the growth of the signal at the fundamental. In addition, engineering design considerations of the waveguide dimensions, the wiggler magnet gap spacing, the wiggler period, and the minimum magnetic field strength in the tapered region of the wiggler. This FEL is designed to produce an average power of about 10 MW at frequencies in the range from 380 GHz to 560 GHz. The achievement of this average power at a reasonable cost requires a high duty factor, which affects some component design. In addition, the desire to obtain a high extraction efficiency pushes the beam energy up and requires magnetic field strengths in the wiggler that are near or possibly larger than the Halbach limit. We used a methodology for our system study that had been developed earlier. We considered several FEL configurations and selected one that minimized total cost. We determined that increasing the beam energy requires that the wiggler use vanadium-permendur as the pole material. We discuss the basic design of the selected configuration and give the expected performance. 19 refs., 9 figs., 2 tabs.

3994 **(UCRL—98716) The physics of free electron lasers and applications to electron cyclotron heating.** Prosnitz, D. (Lawrence Livermore National Lab., CA (USA)). 13 Jul 1988. Contract W-7405-ENG-48. 14p. (CONF-880534—12). NTIS, PC A03/MF A01. Order Number DE89001296/JAW.

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

An induction linac-driven free electron laser (FEL) is considered as a potential source of high-average power millimeter radiation for heating tokamaks. The basic physics of the FEL is reviewed, the state of high-power millimeter experiments is summarized, and a preliminary design induction linac-driven FEL for auxiliary heating is described. 21 refs., 8 figs.

3995 **(UCRL—99075) A second order implicit particle mover with adjustable damping.** Friedman, A. (Lawrence Livermore National Lab., CA (USA)). 6 Oct 1988. Contract W-7405-ENG-48. 28p. (CONF-881041—2). NTIS, PC A03/MF A01. Order Number DE89002659/JAW.

From Meeting of the Division of Plasma Physics of the American Physical Society; Hollywood, FL, USA (30 Oct 1988).

A new algorithm for the calculation of particle trajectories is introduced. The algorithm combines second-order accuracy in the real frequency with third-order user-adjustable attenuation. It requires little storage of data from previous time levels. The method was designed for use in implicit particle-in-cell plasma simulation codes. It may also be useful in other applications where one seeks to preserve the accuracy of low-frequency oscillations while rapidly damping under-resolved high frequency motions. 13 refs., 8 figs.

3996 **(UCRL—99439) Induction-linac based free-electron laser amplifiers for plasma heating.** Jong, R.A. (Lawrence Livermore National Lab., CA (USA)). 22 Aug 1988. Contract W-7405-ENG-48. 4p. (CONF-881226—1). NTIS, PC A02/MF A01. Order Number DE88017004/JAW.

From 13. international conference on infrared and millimeter waves; Honolulu, HI, USA (5 Dec 1988).

We describe an induction-linac based free-electron laser amplifier that is presently under construction at the Lawrence Livermore National Laboratory. It is designed to produce up to 2 MW of average power at a frequency of 250 GHz for plasma heating experiments in the Microwave Tokamak Experiment. In addition, we shall describe a FEL amplifier design for plasma heating of advanced tokamak fusion devices. This system is designed to produce average power levels of about 10 MW at frequencies ranging form 280 to 560 GHz. 7 refs., 1 tab.

3997 **(UCRL—99670) Plasma heating and current drive using intense, pulsed microwaves.** Cohen, B.I.; Cohen, R.H.; Nevins, W.M.; Rognlien, T.D.; Bonoli, P.T.; Porkolab, M. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 21p. (CONF-881124—1). NTIS, PC A03/MF A01. Order Number DE89001127/JAW.

From Joint Varenna-Lausanne workshop on theory of fusion plasmas; Chexbres, Switzerland (3 Nov 1988).

The use of powerful new microwave sources, e.g., free-electron lasers and relativistic gyrotrons, provide unique opportunities for novel heating and current-drive schemes in the electron-cyclotron and lower-hybrid ranges of frequencies. These high-power, pulsed sources have a number of technical advantages over conventional, low-intensity sources; and their use can lead to improved current-drive efficiencies and better penetration into a reactor-grade plasma in specific cases. The Microwave Tokamak Experiment at Lawrence Livermore National Laboratory will provide a test for some of these new heating and current-drive schemes. This paper reports theoretical progress both in modeling absorption and current drive for intense pulses and in analyzing some of the possible complications that may arise, e.g., parametric instabilities and nonlinear self-focusing. 22 refs., 9 figs., 1 tab.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 2858, 3149, 3385, 3396

3998 **(BNL-NCS—41801) ENDF/B-VI nuclear data evaluations for fusion applications.** Dunford, C.L.; Larson, D.C.; Young, P.G. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 11p. (CONF-881031—27). NTIS, PC A03/MF A01. Order Number DE89002187/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The next release of the ENDF/B data library planned for 1989 contains improved data evaluations of interest to the fusion neutronics community. New data formats permit inclusion of energy-angle correlated particle emission spectra and recoil nucleus energy spectra. Enhanced formats for covariance information have been developed. Many new isotopic evaluations will lead to improved energy conservation and kerma factor calculations. Improved nuclear model calculations will provide reliable particle emission data where experimental information is sparse. Improved Bayssian fitting codes will provide more accurate evaluations for data rich reactions such as Li(n,nt)α. All of the most important fusion material evaluations contain these new features. 32 refs., 8 figs.

3999 **(CONF-871007—107) Initial results of systems analysis of the ETR/ITER [Engineering Test Reactor/International Thermonuclear Experimental Reactor] design space.** Peng, Y.K.M.; Galambos, J.D.; Reid, R.L.; Strickler, D.J.; Kalsi, S.; Deleanu, L. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE89001676/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Preliminary versions of the Engineering Test Reactor (ETR) systems code TETRA (Tokamak Engineering Test Reactor Analysis), which determines design solutions by the method of constrained optimization, are used to characterize the International Thermonuclear Experimental Reactor (ITER) and its design parameter space. We find that the physics objectives of high ignition margin and high plasma current lead to minimum size at relatively low aspect ratios (A = 2.5-3.0), while the engineering objective of high neutron wall load (W/sub L/ {approx←gt} 1.0 MW/m^2) leads to minimum size at higher A ({approximately}3.5). For minimum-size ITERs, the optimal toroidal field coil (TFC) designs fall within a narrow range of maximum fields (10-11 T) with R varying over only a few percent despite a factor of two change in the winding pack current density J/sub wp/. The major radius of the design is found to be sensitive to changes in elongation, inboard distances (such as plasma scrape-off), inductive flux capability, plasma temperature, beta limit, and ignition margin. A preliminary characterization of the US ITER designs with plasma current I/sub p/ $>$ 15 MA and R $<$ 4.5 m has been obtained by combining the engineering assumptions for devices such as the Tokamak Ignition/Burn Engineering Reactor (TIBER) with the physics assumptions for devices such as the Compact Ignition Tokamak (CIT) and the Next European Torus (NET). These devices can accommodate a range of full- to reduced-bore, driven (Q $<$ 10), steady-state plasmas for the engineering phase that produces high neutron wall load and fluence. 12 refs., 4 figs., 3 tabs.

4000 **(CONF-871007—108) Radiation analysis of the CIT [Compact Ignition Tokamak] pellet injector system and its impact on personnel access.** Selcow, E.C.; Stevens, P.N.; Gomes, I.C.; Gomes, L.M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE89001672/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Conceptual design of the Compact Ignition Tokamak (CIT) is near completion. This short-pulse ignition experiment is planned to follow the operations of the Tokamak Fusion Test Reactor (TFTR) at the Princeton Plasma Physics Laboratory. The high neutron wall loadings, {approximately}4-5 MW/m^2, associated with

the operation of this device require that neutronics-related issues be considered in the overall system design. Radiation shielding is required for the protection of device components and personnel. A close-in igloo shield has been designed around the periphery of the tokamak structure, and the entire experiment is housed in a circular test cell facility with a radius of {approximately}12 m. The most critical radiation concern in the CIT design process relates to the numerous penetrations in the device. This paper discusses the impact of a major penetration on the design and operations of the CIT pellet injection system. The pellet injector is a major component, which has a line-of-sight penetration through the igloo and test cell wall. All current options for maintenance of the injector require personnel access. A nuclear analysis has been performed to determine the feasibility of hands-on access. Results indicate that personnel access to the pellet injector glovebox is possible. 10 refs., 3 figs., 3 tabs.

4001 **(CONF-871007—122) The Compact Ignition Tokamak project overview.** Shannon, T.E. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE89001936/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

As the next major step in the US fusion program, the Compact Ignition Tokamak (CIT) Project has the objective of reaching ignition in order to address the scientific issues associated with ignited plasma regimes. The present level of uncertainty in plasma confinement scaling requires that the CIT have a high design margin to ensure ignition. The need for adequate margin, coupled with declining budgets in the US fusion program, requires both conservatism and flexibility in the development of the design and operating parameters for the device. To accomplish this, the design includes the provision for an upgrade in performance, which will be partially built into the initial machine installation at Princeton Plasma Physics Laboratory (PPPL). 8 refs., 9 figs., 1 tab.

4002 **(CONF-880512—14) Control of water absorption by purification of graphite.** Simpkins, J.E.; Strehlow, R.A.; Mioduszewski, P.K.; Uckan, T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01. Order Number DE89002200/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

It is well known that graphite can absorb large quantities of water, which can represent an abundant source of oxygen impurities in fusion plasmas if the corresponding components are not properly outgassed. We have outgassed various fusion-relevant graphites (e.g., POCO AXF-5Q) for 1.5 h at 1500{degree}C to release absorbed water and have subsequently exposed the samples to air for various periods of time. Re-absorption of water during the air exposure was estimated by measuring the amount of water produced in subsequent outgassing runs. The results show that the amount of water re-absorbed increases by a factor of approximately 10 within 8 h compared to the sample in the outgassed state but with no air exposure. The water content of the 'as received' material is reached after approximately 30 days. Re-absorption of water was significantly reduced by purification of the investigated graphite samples. This purification process, which consists of heating the sample at 2800{degree}C for 30 min in an argon atmosphere, reduces the levels of trace impurities which can be responsible for catalytic surface reactions on the internal surfaces of the graphite. After exposing an outgassed sample to an electron cyclotron heated plasma followed by 1 h air exposure, the amount of water desorbed was observed to increase by a factor of 6. Data will be presented to correlate this effect with trace impurities. 9 refs., 2 figs., 5 tabs.

4003 **(DOE/ET/53193—5) TEXT database overview.** Miner, W.H.; Wiley, J.C.; Bravenec, R.V.; Patterson, D.M. (Texas Univ., Austin (USA). Fusion Research Center). Jul 1986. Contract AS05-85ER53193. 24p. (FRC—286). NTIS, PC A03/MF A01. Order Number DE89002685/JAW.

This document provides an overview of the structure of the TEXT database and introduces new users to the procedures available for their interaction with it. 6 refs., 5 figs., 3 tabs.

4004 **(EUR—11327) Advances in the electrolysis of tritiated water for its application to a fusion plasma processing plant.** Pierini, G.; Spelta, B. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1988. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755650/JAW.

The exhaust plasma processing scheme, proposed a few years ago as an alternative to the TSTA plant in operation at Los Alamos (N.M.), USA, required further research on some topics such as a low liquid inventory electrolytic cell and the types of separator or membrane resistant to beta radiation. Moreover, it was suggested that the value of the separation factors among H/sub 2/, D/sub 2/, T/sub 2/ should be checked during the electrolysis by using different cathode materials in an alkaline medium. The results of the experimental work carried out on these topics have shown the feasibility of the process although some improvements are still possible as far as the optimization of the separators and the design of the electrolytic cells are concerned. This paper describes the research carried out in the JRC Ispra (Italy) together with some Institutes which have studied contracts with our Establishment.

4005 **(IPP—2/295) 2nd workshop on Wendelstein VII-X, Schloss Ringberg, Bavaria, 13-16 June 1988.** Rau, F.; Wobig, H. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1988. 100p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755582/JAW.

This IPP-Report is based on the 'Summary of the Workshop' by H. Wobig, and contains a number of figures and tables from contributed papers with some short descriptive remarks. About 40 papers were presented at the 2nd Workshop on Wendelstein VII-X. The programme of the workshop is given in appendix 1. There were nearly 50 participants as listed in appendix 2, several of them on a part-time basis. Appendix 3 gives the correspondence for the numbers of figures and tables to those contained in the contributions to the workshop.

4006 **(IYF-R—6-299) Role of charge exchange process in forming of ion charge and energy states in multicomponent laser plasma produced from gas-content solids.** Bedilov, M.R.; Bykovskij, Yu.A.; Beisembaeva, Kh.B.; Sabitov, M.S. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704828/JAW.

Experimental results obtained during the investigation into plasma produced under effect of laser irradiation with q=10/sup 9/-10/sup 11/ W/cm/sup 2/ on a target comprising adopted gases are presented. It is shown that the process of multicharge ion recharging on the gas neutral atom produces a notable effect on the formation of charge and energy state of multicomponent laser plasma. 12 refs.; 4 figs.; 1 tab.

4007 **(JINR-R—4-87-907) Kinetics of muon-catalyzed processes in a deuterium-tritium mixture.** Somov, L.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 15p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704868/JAW.

Submitted to the Organizing Committee of Soviet-American Meeting on Muonic Catalysis, Moscow, 1987.

According to the resonance and quasi-resonance mechanisms of dtμ mesic molecule formation, formation rate λdtμ depends on the temperature of D/sub 2/+T/sub 2/ mixture. The temperature dependence of λdtμ(T) is determined by the energy distribution PHI/sub F/(E) for atoms in 1s-state with the total spin F=0 and F=1. To find PHI/sub F/(E), one should study the kinetics of muon catalysis processes. It is shown that PHI/sub F/(E) and Maxwell distribution, normalyzed to the equal number of mesic atoms, differ by less than 10%. This difference is insignificant due to high rates of processes of mesic atom slowing down and of muon exchange between deuterium and tritium in mesic atom excited states. The solution of the system of equations descirbing the μ-catalysis kinetics is presented for densities phi $<$ 0.05 and with μ-atom "acceleration" during its thermalization included, i.e. when the quasi-stationary approximation is inapplicable. It is shown that, this effect

taken into account, the theory is in a satisfactory agreement with SIN experiments at density phi=0.01. 42 refs.; 6 figs.; 1 tab.

4008 **(LA-UR—88-3382) High power KrF laser development at Los Alamos.** McDonald, T.; Cartwright, D.; Fenstermacher, C.; Figueira, J.; Goldstone, P.; Harris, D.; Mead, W.; Rosocha, L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-881056—6). NTIS, PC A02/MF A01. Order Number DE89002242/JAW.

From 19. European conference on laser interaction with matter (ECLIM); Madrid, Spain (3 Oct 1988).

The objective of the high power laser development program at Los Alamos is to appraise the potential of the KrF laser as a driver for inertial confinement fusion (ICF), ultimately at energy levels that will produce high target gain (gain of order 100). A KrF laser system prototype, the 10-kJ Aurora laser, which is nearing initial system operation, will serve as a feasibility demonstration of KrF technology and system design concepts appropriate to large scale ICF driver systems. The issues of affordable cost, which is a major concern for all ICF drivers now under development, and technology scaling are also being examined. It is found that, through technology advances and component cost reductions, the potential exists for a KrF driver to achieve a cost goal in the neighborhood of $100 per joule. The authors suggest that the next step toward a multimegajoule laboratory microfusion facility (LMF) is an "Intermediate Driver" facility in the few hundred kilojoule to one megajoule range, which will help verify the scaling of driver technology and cost to an LMF size. An Intermediate Driver facility would also increase the confidence in the estimates of energy needed for an LMF and would reduce the risk in target performance. 5 refs., 4 figs., 1 tab.

4009 **(LBL—25097) Research on ion induction linacs at Berkeley.** Fessenden, T.J. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 15p. (HIFAN—389; CONF-8806101—6). NTIS, PC A03/MF A01. Order Number DE89002944/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

Since October 1983, most of the research in the US on heavy ion fusion (HIF) has been devoted to the physics and technology of the induction linac driver. The economic viability of the method was confirmed in the recent HIF Systems Assessment. Research at Berkeley comprises three experimental activities: the multiple-beam experiment, MBE-4, which accelerates four parallel, separately focused beams of cesium ions from 0.2 to 1 MeV; amplification of the beam power by a factor of nearly 40 is observed; development of a 16-beam, pulsed, 2-MV injector; and a single beam transport experiment (SBTE) for studying collective phenomena in ion beam transport. In addition, a major activity has been the development of a physics and engineering design for a larger experiment to test (in a scaled way) almost all of the manipulations needed in a full-scale driver. A complicating feature in the design is the combining of beams (in sets of four to one); the penalty in collectively enhanced emittance growth must be balanced against the cost savings gained in a driver. 12 refs., 6 figs., 1 tab.

4010 **(LBL—25098) Accelerator research on MBE-4, an experimental multi-beam induction linac.** Meuth, H.; Fessenden, T.J.; Keefe, D.; Warwick, A.I. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 22p. (CONF-8806101—5). NTIS, PC A03/MF A01. Order Number DE89002965/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

The multiple beam accelerator MBE-4 is a device for research toward a heavy ion driver for inertial confinement fusion, based on the induction linac concept. Its main goal is proof of the principle of current amplification by acceleration and controlled self-similar beam pulse compression. Into the 16-m long device four beams, each with an initial current of 10 mA are injected from a Marx-driven diode at 200 keV. The current amplification is up to nine-fold, with a final beam energy of about 800 keV in the middle of the bunch. Now that all the apparatus' accelerator sections have been completed, installed and aligned, and its unaccelerated transport properties have been studied, our experimental research has reached the crucial phase of implementing appropriate accelerator schedules that approximate self-similar current-pulse compression. These schedules are established through a close interplay of computations using a one-dimensional simulation code and a manual empirical tuning procedure. In a first approach, with a rather vigorous schedule that uses most of the accelerator modules to their voltage limits, we have determined the limits of our capability for controlled pulse compression, mainly due to waveform shaping of the driving pulse-forming networks. We shall report on these results. In the future, we will also aim for gentler schedules that would model more closely an inertial confinement fusion scenario. 8 refs., 11 figs., 1 tab.

4011 **(LBL—25922) Heavy ion driver technology.** Keefe, D. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 17p. (CONF-880928—4; HIFAN—405). NTIS, PC A03/MF A01. Order Number DE89002920/JAW.

From Course and workshop on inertial confinement fusion; Varenna, Italy (6 Sep 1988).

Major differences between fusion drivers and traditional accelerators include the following. The final beam current needed ({approximately}20 kA in a short pulse) is very much larger for a driver; such beams are dominated by repulsive space-charge effects since, even at 10 GeV, the ions are non-relativistic (v/c = 0.3). Also, the optical quality of the beams (called emittance by accelerator people) must be extremely good to ensure a suitably small focal spot at the pellet. Two schemes, one with a rf linac and storage rings, the other with a single-pass current-amplifying induction linac, are under study, the latter exclusively in the US. The induction linac approach lends itself to an examination in a sequence of scaled-down laboratory experiments since the most difficulties are expected to occur at the low energy end. Experiments and simulation have centered on a study of the transverse and longitudinal control of space-charge-dominated beams which are best described in terms of a non-neutral plasma rather than the traditional single-particle dynamics picture. An understanding of the high-current instability limits is required for arriving at a safe driver design. The final on-target beam current is so high that it must be carried in 16 separate focusing channels leading into the combustion chamber. While the energy deposition of the ions is expected to be entirely classical, there is a wealth of plasma physics phenomena to be explored (by theory and simulation) in the final propagation of these beams through the low-density gas in the chamber and in the environment of the hot target; it is important that none of these could result in a significant portion of the beam missing the focal spot. 13 refs., 9 figs., 1 tab.

4012 **(NRL-MR—6333) Beam profile studies for a one eighth betatron wavelength final focusing cell following phase mixed transport.** Watrous, J.J.; Ottinger, P.F. (Naval Research Lab., Washington, DC (USA)). 26 Oct 1988. Contract AI03-79DP40092. 62p. NTIS, PC A04/MF A01. Order Number DE89002508/JAW.

The focusing properties of a one eighth betatron wavelength focusing cell are used to determine to what extent a modification of the initial phase space distribution of an ion beam can alter the number density profile of the beam at the focal plane. It is shown that the main modification is to alter the natural 1/r profile to include an off-axis peak. The relative difficulty with which the ion beams can be concentrated into this off-axis peak is then considered. Estimates of the source brightness (extraction ion diode source current density divided by the square of the microdivergence) required to deliver a given amount of beam current into a given annular region at the focal plane are derived. 10 refs., 25 figs.

4013 **(UCID—21540) Design and construction of Blumlein generator for Mirrortron Experiment.** Weisgraber, T. (Lawrence Livermore National Lab., CA (USA)). 2 Sep 1988. Contract W-7405-ENG-48. 18p. NTIS, PC A03/MF A01. Order Number DE89002855/JAW.

A low impedance, fast rise Blumlein pulse generator was constructed and tested to verify the predicted output and to determine the feasibility of its application to the Mirrortron Experiment. The line was designed to produce a 30 ns pulse and operate between 50 and 200 volts. A solenoid driven tack was used as the

switch. Voltage and current probes were used to examine the output. Two versions of the generator were built with different line impedances, dielectrics, and switch designs. The second model outperformed the first and is suitable for the intended experimental applications. 11 figs.

4014 **(UCRL—21127) Studies of plasma phenomena in laser fusion; Backward Compton scattering for probing ultra high fields of space charge waves: Final report, 7 August 1983--9 March 1987.** Joshi, Chan. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 54p. NTIS, PC A04/MF A01. Order Number DE89002650/JAW.

This is a summary of some ongoing computational studies on the physics of wave particle interactions in the laser beat wave accelerator. The purpose for doing these studies is to directly support the experimental efforts now in progress by resolving the theory in terms of our laboratory parameters. By merging the experimental restrictions into the theory computationally, we might better predict the outcome of the experiments and may modify the diagnostics accordingly. We discuss three separate studies herein. First, we calculate the electron trapping threshold energy and maximum energy gain, and compare these with thresholds and energy gains that are experimentally feasible. Secondly, we study numerically the phase space orbit of a single electron in the laboratory frame and plasma wave frame in order to understand particle dynamics in terms of laboratory parameters. Lastly, we incorporate the radial fields of the plasma wave into the computations in order to understand how these fields may modify the electron trajectories. 5 refs., 6 figs.

4015 **(UCRL—96101-Rev.1) Organic nonlinear crystals and high power frequency conversion.** Velsko, S.P.; Davis, L.; Wang, F.; Monaco, S.; Eimerl, D. (Lawrence Livermore National Lab., CA (USA)). Dec 1987. Contract W-7405-ENG-48. 17p. (CONF-8708110—40-Rev.1). NTIS, PC A03/MF A01. Order Number DE89002665/JAW.

From 31. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA, USA (16 Aug 1987).

We are searching for a new second- and third-harmonic generators among the salts of chiral organic acids and bases. We discuss the relevant properties of crystals from this group of compounds, including their nonlinear and phasematching characteristics, linear absorption, damage threshold and crystal growth. In addition, we summarize what is known concerning other nonlinear optical properties of these crystals, such as two-photon absorption, nonlinear refractive index, and stimulated Raman thresholds. A preliminary assessment is made of the potential of these materials for use in future high power, large aperture lasers such as those used for inertial confinement fusion experiments. 14 refs., 1 fig., 3 tabs.

4016 **(UCRL—96200) Radiation imposed limits on superconducting magnets: A data base for copper stabilizers.** Guinan, M.W.; Hahn, P.A.; Klabunde, C.E.; Coltman, R.R. Jr. (Lawrence Livermore National Lab., CA (USA)). 28 Oct 1987. Contract W-7405-ENG-48. 17p. (CONF-871036—37). NTIS, PC A03/MF A01. Order Number DE89002875/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

Two of eight differently prepared copper stabilizer samples, previously irradiated in the RTNS-II at LLNL, the IPNS-1 and the BSR at ORNL, have been irradiated to a fluence of 1.33 {times} 10^{22} n/m^2 at RTNS-II. During the course of the irradiation the samples were periodically removed (without warming) for measurements of the transverse magnetoresistance and returned for continued irradiation. This experiment extends the range of neutron-irradiation-induced resistivity by a factor of five over the previous experiments. A simple model is developed which reproduces the magnetoresistance results of all the experiments to an accuracy of 2.5%. 13 refs., 6 figs.

4017 **(UCRL—97499) Shield walls for the microwave tokamak experiment (MTX) facility.** Felker, B. (Lawrence Livermore National Lab., CA (USA)). 9 Oct 1987. Contract W-7405-ENG-48. 5p. (CONF-871007—127). NTIS, PC A02. Order Number DE89002284/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The Alcator-C machine to be installed in the MTX facility will be housed in a one-foot-thick shield wall at Lawrence Livermore National Laboratory (LLNL). This facility differs from the housing at the Massachusetts Institute of Technology (MIT) in that the expected radiation levels are estimated to be higher because the free electron laser (FEL) will heat the plasma. The shield walls that surround the experiment will have a large amount of rebar and metal structure that will be isolated to various degrees to maintain grounding isolation, minimize grounding loops, and minimize currents that could disrupt diagnostic abilities, cause personnel hazards, or affect plasma location. The walls are also designed to LLNL earthquake standards. Construction started in June and was completed by late July. Details of the design criteria for radiation, earthquake, and electrical isolation, along with the design, construction, and related issues will be presented in the paper. 4 refs., 8 figs.

4018 **(UCRL—98536) Optimized multi-modal-operation designs for ITER [International Thermonuclear Experimental Reactor].** Blackfield, D.T.; Perkins, L.J.; Devoto, R.S.; Fenstermacher, M.E.; Ho, S.K. (Lawrence Livermore National Lab., CA (USA)). 7 Oct 1988. Contract W-7405-ENG-48. 6p. (CONF-881031—31). NTIS, PC A02/MF A01. Order Number DE89002897/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The tokamak nonlinear optimization systems code TETRA has been expanded to contain the option of examining machine designs capable of "multi-modal" operations. The conceptual International Thermonuclear Experimental Reactor (ITER) is an example of a "bi-modal" operating machine design in that it must be capable of both pulse-ignited and steady-state operations. This new version of TETRA allows for the optimization of a "figure-of-merit" which may involve several operating scenarios. We obtain for ITER minimum cost designs which are capable of igniting when operated in the pulsed mode as well as have reasonable $Q > 5$ when operated in steady-state. 3 refs., 3 tabs.

4019 **(UCRL—98828) Progress toward high-gain laser fusion.** Storm, E. (Lawrence Livermore National Lab., CA (USA)). 28 Sep 1988. Contract W-7405-ENG-48. 5p. (CONF-881056—5). NTIS, PC A02/MF A01. Order Number DE89002661/JAW.

From 19. European conference on laser interaction with matter (ECLIM); Madrid, Spain (3 Oct 1988).

A 1985-1986 Review of the US inertial confinement fusion program by the National Academy of Sciences concluded that five more years might be required to obtain enough data to determine the future course of the program. Since then, data from the Nova laser and from the Halite/Centurion program have resolved most of the outstanding problems identified by the NAS review. In particular, we now believe that we can produce a sufficiently uniform target; that we can keep the energy content in hot electrons and high-energy photons low enough ({approximately}1--10% of drive energy, depending on target design) and achieve enough pulse-shaping accuracy ({approximately}10%, with a dynamic range of 100:1) to keep the fuel on a near-Fermi-degenerate adiabat; that we can produce an {approximately}100-Mbar pressure pulse of sufficient uniformity ({approximately}1%), and can we control hydrodynamic instabilities so that the mix of the pusher into the hot spot is low enough to permit marginal ignition. These results are sufficiently encouraging that the US Department of Energy is planning to complete a 10-MJ laboratory microfusion facility to demonstrate high-gain ICF in the laboratory within a decade. 22 refs., 1 fig.

4020 **(UCRL—99002) Simulations of heavy ion fusion beam compression with quadrupole focusing: Development of 3D capability.** Mark, J.W.K.; Friedman, A.; Chang, Chia-Lie; Drobot, A.; Mankofsky, A. (Lawrence Livermore National Lab., CA (USA)). 30 Jun 1988. Contract AC04-76DP00789. 6p. (CONF-880713—20). NTIS, PC A02/MF A01. Order Number DE89001500/JAW.

From Beams '88: 7th international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Longitudinal beam compression is essential to produce the requisite peak power for driving ICF targets; it could also produce the proper pulse shapes. Realistic effects of quadrupole focusing and displaced beam centroid in the presence of space charge are being studied with the help of the 3D ARGUS particle-in-cell (PIC) code. We discuss the results and code development for these studies.

4021 **(UCRL—99256) Recent Livermore research on ion beam fusion targets.** Mark, J.W.K. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 6p. (CONF-880713—19). NTIS, PC A02/MF A01. Order Number DE89001494/JAW.

From Beams '88: 7th international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Targets using indirect drive optimize symmetry and are the mainline approach at LLNL based on a number of favorable factors. Recently we have also investigated several examples of ion beam targets that use the energy efficiency of direct drive while at the same time optimizing on the symmetry requirements. Heavy ion beams of charge state $Z \geq 3$ at 5-10 GeV have $\leq$15-20 m bending radii with 3.5 Tesla fields. Beams like them could be used with targets involving direct drive. Control of asymmetries in direct-drive ion beam targets depends on control of the effects of residual target asymmetries after an appropriate illumination scheme has been adopted. In this article, we outline results on our investigations into ion beam target concepts in which the effects of residual asymmetries are ameliorated. Thirty-two beams are placed according to our axially symmetric Gaussian-quadrature illumination scheme. The targets survive the effects of residual asymmetries in our recent 2D hydrodynamic simulations. 7 refs., 5 figs.

4022 **(UCRL—99427) Progress in laboratory high gain ICF [inertial confinement fusion]: Prospects for the future.** Storm, E.; Lindl, J.D.; Campbell, E.M.; Bernat, T.P.; Coleman, L.W.; Emmett, J.L.; Hogan, W.J.; Hunt, J.T.; Krupke, W.F.; Lowdermilk, W.H. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 32p. (CONF-8808101—3). NTIS, PC A03/MF A01. Order Number DE89002664/JAW.

From International seminar on nuclear war; Erice, Italy (19 Aug 1988).

Inertial confinement fusion (ICF), a thermonuclear reaction in a small ({approximately}5 mm diameter) fuel capsule filled with a few milligrams of deuterium and tritium, has been the subject of very fruitful experimentation since the early 1970's. High gain ICF is now on the threshold of practical applications. With a Laboratory Microfusion Facility (LMF), these applications will have major implications for national defense, basic and applied science, and power production. With a driver capable of delivering about 10 MJ in a 10-ns pulse at an intensity of {approximately}3 {times} 10^{14} W/cm^2, an appropriately configured cryogenic capsule could be compressed to a density of about 200 g/cm^3 and a temperature of 3--5 keV. Under these conditions, up to 10 mg of DT could be ignited, and with a burn efficiency of about 30%, release up to 1000 MJ of fusion energy, an energy gain of about 100. A thousand megajoules is equivalent to about one quarter ton of TNT, or about 7 gallons of oil--an amount of energy tractable under laboratory conditions and potentially very useful for a variety of applications. 61 refs., 33 figs.

4023 **(UCRL—99701) Recent results from the Nova experiments program.** Kauffman, R.L.; Cable, M.D.; Campbell, E.M.; Glendinning, S.G.; Hatcher, C.W.; Hatchett, S.P.; Kania, D.R.; Kilkenny, J.D.; Kornblum, H.N.; Kyrazis, D.T. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 4p. (CONF-881056—7). NTIS, PC A02/MF A01. Order Number DE89002901/JAW.

From 19. European conference on laser interaction with matter (ECLIM); Madrid, Spain (3 Oct 1988).

I review recent experimental results using the Nova laser. The experiments primarily address the physics of indirect-drive ICF. These experiments include investigating high-Z plasmas and radiation production, hydrodynamic stability, and high convergence implosions. The high-Z plasma experiments used a variety of targets to study the complex dynamics and ionization physics of high-Z plasmas. In long pulse irradiations of Au disks with 0.35-μm light, x-ray conversion efficiencies greater than 70% have been demonstrated. In collaboration with AWE, we have quantitatively measured material mix at an unstable accelerated interface. In other experiments, we have observed growth of modulations due to Rayleigh-Taylor instabilities in accelerated samples. Radiation-driven implosions experiments have demonstrated radial convergences of 30 fold with good agreement with one-dimensional hydrodynamic simulations. Presently these experiments are limited to about 20 kJ of 0.35-μm light due to damage in the amplifier glass. We are presently installing new amplifier glass which will allow routine operation at 120 kJ of 1ω light in a 2.5-ns pulse. In addition, we are significantly increasing our ability to measure and control the laser pulse shape. With these improvements, we will be able to perform high-power pulse-shaped experiments needed for high density implosions. 2 refs., 4 figs.

4024 **(WHC-SA—0299) Accommodation of liquid metal by cavity liners.** Jeppson, D.W. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1988. Contract AC06-87RL10930. 15p. (CONF-881031—30). NTIS, PC A03/MF A01. Order Number DE89002244/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Present liquid metal breeder reactor cell liner designs appear adequate to contain postulated leakages of lithium-lead alloy in an air or steam atmosphere and to contain lithium when inert atmospheres are present. If an air or steam atmosphere may be present in a cavity where lithium may accumulate under postulated accident conditions, then consideration of stainless steel liners and further testing is recommended. Lithium testing of faulted liners should also be considered. SOFIRE II and WATRE computer codes may be useful in establishing liner design requirements and in determining water release from concrete behind the liners (potential hydrogen production) for postulated leakages to steel-lined concrete cavities. 1 ref., 10 figs.

4025 **(WHC-SA—0300) Safety considerations for steam coolant with liquid metal breeders.** Jeppson, D.W. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1988. Contract AC06-87RL10930. 12p. (CONF-881031—26). NTIS, PC A03/MF A01. Order Number DE89002142/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Test results indicate the rate and quantity of hydrogen generation, aerosol characterization and release rates, radioactive species behavior, and potential attack on blanket candidate metals for postulated fusion reactor accident conditions when steam may be used near lithium breeder material. These results can be used to evaluate specific reactor safety concerns and to develop computer code models to predict consequences of postulated accidents involving steam and lithium. 7 figs., 4 tabs.

4026 **Method and apparatus for producing an ultra-high controlled transient temperature with an electrical discharge.** McCorkle, R.A. (to International Business Machines Corp., Armonk, NY). US Patent 4,759,894. 26 Jul 1988. Filed date 24 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a capillary discharge apparatus, comprising: means for defining a capillary having walls comprising condensed phase thermonuclear fusible material and having a selected diameter D and length L such that L/D is at least 100; means for creating an electrical current discharge along the axis of the capillary to produce a plasma within the capillary; and means for actuating the electrical discharge current creating means to create a current discharge with sufficient amplitude and rise time for the selected D and L to cause a core plasma to be formed within the capillary at a temperature of at least 2 million degrees Kelvin and greater.

4027 **Getter pump for hydrogen and hydrocarbon gases.** Hsu, Wen Ling. US Patent Application 6-108,326. 14 Oct 1987. 13p. Contract AC04-76DP00789. DE89000185 NTIS, PC A03/MF A01. Order Number DE89000185/JAW.

A gettering device for hydrogen isotopes and gaseous hydrocarbons based on the interaction of a plasma and graphite used as cathodic material. The plasma is maintained at a current density within the range of about 1 to about 1000 mA/cm^2. The graphite may be heated to a temperature greater than 1000{degree}C. The new device offers high capacity, low noise, and gas species selectivity. 2 figs.

99 GENERAL AND MISCELLANEOUS

9901 Management

REFER ALSO TO CITATION(S) 4073

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 2815, 2985, 3111, 3298, 3332, 3350, 3362, 3451, 3731, 3769, 3940, 3941, 3995, 4003, 4035, 4071, 4078

4028 **(AD-A—196416/2/XAB) Type architectures, shared memory, and the corollary of modest potential. Technical report.** Snyder, L. (Washington Univ., Seattle (USA). Dept. of Computer Science). Jul 1986. 40p. (TR—86-03-04). NTIS, PC A03/MF A01.

The influence of the programming-language model to specifying parallelism is explained: the SOR algorithm is used as an illustration; the concept of type of computer architecture - an idealized machine specifying the language/architecture interface - is introduced; it is observed that the paracomputer (=CRCW -PRAM) has frequently been used as a type architecture, but it is inadequate; Valiant's maximum finding algorithm, though optimal for the CRCW-PRAM is proved to be suboptimal in practice; this is interpreted as evidence for the inadequacy of the paracomputer as a type architecture; alternate-type architectures that avoid this problem are discussed.

4029 **(AD-A—196419/6/XAB) Poker (4.1): a programmer's reference guide. Technical report.** Snyder, L. (Washington Univ., Seattle (USA). Dept. of Computer Science). Apr 1988. 97p. (TR—83-03-03). NTIS, PC A05/MF A01.

This document gives a succinct description of the facilities available with the Poker Parallel Programming Environment. The emphasis is on what is available rather than how to achieve particular results. Although the sections are self-contained, so that they may be referred to independently, there are a few things to be noted: 1) Poker uses interactive graphics. The graphics are described in Section 2; the interaction is described in Section 3; 2) The usual programming language notion of a source program as a monolithic piece of symbolic text has been replaced in Poker by a data base. The way to create, view, and change the data base is described in Section 4; 3) Object programs (the compiled database) are executed or emulated by Poker and snapshots of the execution can be continuously displayed; 4) Poker supports a variety of CHiP architectures; the current one can be displayed or changed using the CHiP Parameters facility; Section 7; 5) The back page of this document gives a summary of the commands; and 6) Other versions of Poker exists; consult Appendix B for your particular system.

4030 **(AD-A—196458/4/XAB) Communication aspects of parallel processing.** Oezveren, C. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Information and Decision Systems). 4 Dec 1988. 51p. (LIDS-P—1721). NTIS, PC A04/MF A01.

Parallel processing was motivated by the need to solve very large computational problems, such as the numerical solutions of partial differential equations in the context of computational fluid dynamics, structural mechanics, image processing, etc. This report surveys recent literature on parallel-processing algorithms for mainly rings, meshes, and hypercubes. These algorithms include vector, matrix computations, fixed-point iterations, and linear-equation solvers. A group property of above topologies was also explored in an attempt to develop tools for algorithms and performance analysis. Some special sparsity structure of the iteration dependencies was also examined. A necessary and sufficient condition for the reducibility of a dependency matrix with sparse, nonzero extended diagonals was derived.

4031 **(AD-A—196610/0/XAB) Design of ISI's (Information Sciences Institute) initial prototype SDI architecture simulator. Research report.** Mizell, D.; Tung, Y.W.; Coatney, S.; Carter, S.; Sherman, R. (University of Southern California, Marina Del Rey (USA). Information Sciences Inst.). Mar 1988. 57p. (ISI/RR—88-205). NTIS, PC A04/MF A01.

This report describes the software design of the first prototype strategic defense architecture simulation system developed under ISIs SDI Communications Research contract. While the long-term goal of the simulation task is to investigate techniques for speeding up simulators of this type via parallelism, this system is a sequential program in which it must be possible to: incorporate nontrivial, executable representations of the battle-management computations taking place on any defense platform within the simulation; and change the candidate defense architecture being modeled independently of the simulation software that models the external physical environment. The report documents the authors approach to designing a simulator that meets those requirements. It includes both a description of the software design and some historical material about their design process: design decisions made, why they wre made; and alternatives were considered at the time.

4032 **(AD-A—196931/0/XAB) Parallel-programming paradigms. Doctoral thesis.** Nelson, P.A. (Washington Univ., Seattle (USA). Dept. of Computer Science). Jul 1987. 142p. (TR—87-07-02). NTIS, PC A07/MF A01.

Paradigms for the development of sequential algorithms, such as divide-and-conquer and the greedy method, are well known. Paradigms for the development of parallel algorithms, especially algorithms for non-shared memory MIMD machines, are not well known. These paradigms are important, not only as tools for the development of new algorithms, but also because algorithms using the same paradigm often have common properties that can be exploited by operations such as contraction. This dissertation identifies four primary paradigms used by non-shared memory MIMD algorithms. They are compute-aggregate-broadcast, divide-and-conquer, pipelining, and reduction. Compute-aggregate-broadcast is used, for example, in numerical approximation algorithms like the conjugate gradient iterations. Three variations of the compute-aggregate-broadcas t paradigm are studied. Divide-and-conquer is shown to be applicable to parallel algorithms. The relationship between divide-and-conquer algorithms and the n-cube is studied. Systolic techniques are known to be broadly applicable for the development of MIMD algorithms. Systolic algorithms are shown to be members of the more general pipelining paradigm. Finally, the reduction paradigm is briefly studied. The contraction problem, the problem arising when an algorithm requires more processors than are available on the execution machine, is studied. Special attention is given to common solutions to the contraction problem in each paradigm.

4033 **(AD-A—196942/7/XAB) Parallel logic programming and ZMOB. Final report, 30 June 1982-13 February 1988.** Minker, J.; Weiser, M. (Maryland Univ., College Park (USA)). 26 Apr 1988. 12p. NTIS, PC A03/MF A01.

This final report presents a summary of research accomplished to investigate parallel problem solving. Under the current grant, a parallel problem-solving system, PRISM (Parallel Inference System), that was implemented on the VAX/11-780, the PYRAMID and SUN machines, was ported successfully to McMOB and then to the BBN Butterfly parallel architecture. The McMOB architecture is essentially the ZMOB architecture with 16 Motorola 68000 processors, upgrading the Z80A microprocessors, interconnected in a ring structure. Experimental testing of PRISM on McMOB was undertaken in the current year. In addition, several enhancements were made to PRISM to permit experimental analyses to be made, and to incorporate additional features to take full advantage of parallelism in a problem-solving environment. The tracing and statistical gathering packages were extended. An ability to display AND-parallelism was added to the trace program, which displays the execution of a program on the parallel machines. In addition to the above, work continued in the area of informative answers to be presented to a user. Heuristic techniques were developed to determine which information to display.

4034 **(ANL—88-17) Users' guide to Toolpack/1 tools for data dependency analysis and program transformation.** Cowell, W.R. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 38p. NTIS, PC A03/MF A01. Order Number DE89002829/JAW.

This is a guide to the use of a collection of software tools for data dependency analysis and program transformation. The tools are written in Fortran in the tool-writing environment provided by Toolpack/1 and are easily incorporated into a Toolpack/1 installation. We focus on a Unix environment in which Berkeley Unix C-shell scripts provide the user interface to the tools. In this report, the operation of the tools is described in terms of two scripts named args and trans. 5 refs.

4035 **(CONF-880117—7) Finding eigenvalues and eigenvectors of unsymmetric matrices using a hypercube multiprocessor.** Geist, G.A.; Ward, R.C.; Davis, G.J.; Funderlic, R.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01. Order Number DE89002311/JAW.

From 3. conference on hypercube concurrent computers and applications; Pasadena, CA, USA (19 Jan 1988).

Distributed-memory algorithms for finding the eigenvalues and eigenvectors of a dense unsymmetric matrix are given. While several parallel algorithms have been developed for symmetric systems, little work has been done on the unsymmetric case. Our parallel implementation proceeds in three major steps: reduction of the original matrix to Hessenberg form, application of the implicit double-shift QR algorithm to compute the eigenvalues, and back transformations to compute the eigenvectors. Several modifications to our parallel QR algorithm, including ring communication and pipelining, are discussed and compared. Results and timings are given. 5 refs., 3 figs.

4036 **(CONF-8810187—2) User interfaces to expert systems.** Agarwal, A.; Emrich, M.L. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01. Order Number DE89002221/JAW.

From 24. annual meeting of the Institute of Management Science - Southeastern Chapter; Myrtle Beach, SC, USA (6 Oct 1988).

Expert Systems are becoming increasingly popular in environments where the user is not well versed in computers or the subject domain. They offer expert advice and can also explain their lines of reasoning. As these systems are applied to highly technical areas, they become complex and large. Therefore, User Systems Interfaces (USIs) become critical. This paper discusses recent technologies that can be applied to improved user communication. In particular, bar menus/graphics, mouse interfaces, touch screens, and voice links will be highlighted. Their applications in the context of SOFTMAN (The Software Manager Apprentice) a knowledge-based system are discussed. 18 refs., 2 figs.

4037 **(CONF-8810187—3) Rule-based approach to operating system selection: RMS vs. UNIX.** Phifer, M.S.; Sadlowe, A.R.; Emrich, M.L.; Gadagkar, H.P. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02. Order Number DE89002217/JAW.

From 24. annual meeting of the Institute of Management Science - Southeastern Chapter; Myrtle Beach, SC, USA (6 Oct 1988).

A rule-based system is under development for choosing computer operating systems. Following a brief historical account, this paper compares and contrasts the essential features of two operating systems highlighting particular applications. AT&T's UNIX System and Datapoint Corporations's Resource Management System (RMS) are used as illustrative examples. 11 refs., 3 figs.

4038 **(DOE/MA—0320(Vol.1)) Guideline for development of unclassified computer security awareness and training programs.** (Oak Ridge National Lab., TN (USA)). Feb 1988. 153p. NTIS, PC A08/MF A01. Order Number DE89002479/JAW.

This guide presents fundamental concepts, topics, and materials on many aspects of unclassified computer security that should be included in site level unclassified computer security awareness and training (CSAT) programs. These programs are intended for Department of Energy (DOE) and DOE contractor personnel involved in the management, operation, or use of unclassified Federal computer systems, including microcomputers and word processors. The purpose of this guide is not to specify mandatory requirements, but to provide information that can be selectively used in varying combinations for developing an effective training program that is best suited to a particular organization and audience.

4039 **(LA—11371-MS) Generalized finite strains, generalized stresses, and a principle of virtual work for finite-element computer programs.** Cook, W.A.; Genin, J. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 28p. NTIS, PC A03/MF A01. Order Number DE89002102/JAW.

This report compares strain and stress tensors and virtual work principles of the Lagrangian and Eulerian formulations. A generalized formulation is presented that includes the Lagrangian and Eulerian formulations as special cases. This formulation uses a reference configuration that is a linear combination of the deformed and undeformed configurations. Generalized strain and stress tensors are presented that include, as special cases, Green strain and Piola--Kirchhoff stress tensors of the Lagrangian formulation and Almansi strain and Cauchy stress tensors of the Eulerian formulation. Similarly, a generalized virtual work principle is presented that includes, also as special cases, the principles of virtual work for the Lagrangian and Eulerian formulations. Two approaches are presented for solving nonlinear stress analysis problems with the generalized formulation. Both use the finite-element method to approximate equilibrium: one iterates the nodal displacements, and the other iterates the incremental displacements. 3 refs.

4040 **(LA—11372-MS) Generalized finite strains, generalized stresses, and a hybrid variational principle for finite-element computer programs.** Cook, W.A. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 25p. NTIS, PC A03/MF A01. Order Number DE89002101/JAW.

A generalized hybrid variational principle is presented that includes, as special cases, hybrid variational principles for the Lagrangian and Eulerian formulations. This generalized hybrid principle approximates equilibrium and constitutive equations. This report is an extension of a similar report entitled "Generalized Finite Strains, Generalized Stresses, and a Principle of Virtual Work for Finite-Element Computer Programs." Two approaches are presented for solving nonlinear stress analysis problems with this generalized hybrid variational principle. Both use the finite-element method: one interates the nodal displacements, and the other iterates the incremental displacements. 4 refs.

4041 **(LA—11409-T) Algorithms and architectures for adaptive least squares signal processing, with applications in magnetoencephalography.** Lewis, P.S. (Los Alamos National Lab., NM (USA)). Oct 1988. Contract W-7405-ENG-36. 274p. NTIS, PC A13/MF A01. Order Number DE89002380/JAW.

Least squares techniques are widely used in adaptive signal processing. While algorithms based on least squares are robust and offer rapid convergence properties, they also tend to be complex and computationally intensive. To enable the use of least squares techniques in real-time applications, it is necessary to develop adaptive algorithms that are efficient and numerically stable, and can be readily implemented in hardware. The first part of this work presents a uniform development of general recursive least squares (RLS) algorithms, and multichannel least squares lattice (LSL) algorithms. RLS algorithms are developed for both direct estimators, in which a desired signal is present, and for mixed estimators, in which no desired signal is available, but the signal-to-data cross-correlation is known. In the second part of this work, new and more flexible techniques of mapping algorithms to array architectures are presented. These techniques, based on the synthesis and manipulation of locally recursive algorithms (LRAs), have evolved from existing data dependence graph-based approaches, but offer the increased flexibility needed to deal with the structural complexities of the RLS and LSL algorithms. Using these techniques, various array architectures are developed for each of the RLS and LSL algorithms and the associated space/time tradeoffs presented. In the final part of this work, the application of these algorithms is demonstrated by their employment in the enhancement of single-trial auditory evoked responses in magnetoencephalography. 118 refs., 49 figs., 36 tabs.

4042 **(LA-UR—88-1394) Development of forecasting capability by using microcomputers.** Yamada, T.; Williams, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 23p. (CONF-881211—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009111/JAW.

From Symposium on small computers for fluid mechanics; Chicago, IL, USA (1 Dec 1988).

Two microcomputers, a SUN 3 workstation and an IBM/PC-AT with a 32 bit OPUS Clipper board, were used to run a three-dimensional atmospheric code which simulated well the nocturnal drainage winds observed in Rush Valley, approximately 60 km southwest of Salt Lake City, Utah. The performance of the microcomputers was evaluated against the results obtained with a CRAY X-MP. Either microcomputer tested here is powerful enough to conduct extensive research in atmospheric boundary layer modeling.

4043 **(LA-UR—88-1792) A document preparation system in a large network environment.** Vigil, M.; Bouchier, S.; Sanders, C.; Sydoriak, S.; Wheeler, K. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-881223—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014466/JAW.

From ACM conference on document processing systems; Santa Fe, NM, USA (5 Dec 1988).

At Los Alamos National Laboratory, we have developed an integrated document preparation system that produces publication-quality documents. This system combines text formatters and computer graphics capabilities that have been adapted to meet the needs of users in a large scientific research laboratory. This paper describes the integration of document processing technology to develop a system architecture, based on a page description language, to provide network-wide capabilities in a distributed computing environment. We describe the Laboratory requirements, the integration and implementation issues, and the challenges we faced developing this system.

4044 **(LA-UR—88-2083) A training program for scientific supercomputing users.** Hanson, F.; Moher, T.; Sabelli, N.; Solem, A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 18p. (CONF-881112—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014417/JAW.

From Supercomputing conference; Orlando, FL, USA (14 Nov 1988).

There is need for a mechanism to transfer supercomputing technology into the hands of scientists and engineers in such a way that they will acquire a foundation of knowledge that will permit integration of supercomputing as a tool in their research. Most computing center training emphasizes computer-specific information about how to use a particular computer system; most academic programs teach concepts to computer scientists. Only a few brief courses and new programs are designed for computational scientists. This paper describes an eleven-week training program aimed principally at graduate and postdoctoral students in computationally-intensive fields. The program is designed to balance the specificity of computing center courses, the abstractness of computer science courses, and the personal contact of traditional apprentice approaches. It is based on the experience of computer scientists and computational scientists, and consists of seminars and clinics given by many visiting and local faculty. It covers a variety of supercomputing concepts, issues, and practices related to architecture, operating systems, software design, numerical considerations, code optimization, graphics, communications, and networks. Its research component encourages understanding of scientific computing and supercomputer hardware issues. Flexibility in thinking about computing needs is emphasized by the use of several different supercomputer architectures, such as the Cray X/MP48 at the National Center for Supercomputing Applications at University of Illinois at Urbana-Champaign, IBM 3090 600E/VF at the Cornell National Supercomputer Facility, and Alliant FX/8 at the Advanced Computing Research Facility at Argonne National Laboratory. 11 refs., 6 tabs.

4045 **(LA-UR—88-2732) Grid generation software engineering at Los Alamos.** Clark, G.L.; Ankeny, L.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-881230—1). NTIS, PC A02/MF A01. Order Number DE88016233/JAW.

From 2. international conference on numerical grid generation in computational fluid dynamics; Miami Beach, FL, USA (5 Dec 1988).

We have collected and re-engineered a small library of computer codes for general-purpose grid generation in one-, two-, and three-dimensional domains. The design intent was to produce easy-to-use general purpose codes that are portable to as many different hardware and software environments as practical, that are consistent in programming style and user interface, and that cover a gamut of applications. The paper describes some of the features of the codes, emphasizing the perspective of the potential user or programmer, rather than that of the researcher interested in mathematical techniques. 7 refs., 3 figs.

4046 **(NBI-HE—88-27) Order parameter for networks of automata.** Flyvbjerg, H. (Niels Bohr Inst., Copenhagen (Denmark)). May 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755197/JAW.

An exact polynomial equation is given for the size of the stable core of networks of automata with random connections. When the connectivity K of a network equals 1, 2, 3, 4, or 5 this equation is exaclty solvable. It is found that the size of the stable core is an order parameter for a phase transition well known from Kauffman's model. A new derivation of critical parameter values follows. The phase structure is found to be independent of the updating scheme used in the dynamical law for the network.

4047 **(ORNL/DSRD—11) Proceedings of the Third International Symposium of Methodologies for Intelligent Systems: Colloquia program.** Emrich, M.L. (ed.); Ras, Z.W. (ed.); Saiita, L. (ed.); Phifer, M.S. (ed.). (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 136p. (CONF-881090—). NTIS, PC A07. Order Number DE89001300/JAW.

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

This report contains papers from the third international symposium on methodologies for intelligent systems. The main topics covered in this report are: intelligent interfaces; learning and logic; expert systems and data bases; and knowledge representation. Selected papers have been processed for inclusion in the energy data base. (LSP)

4048 **(PB—88-241179/XAB) Data communication network at NLR for supercomputer usage.** (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam (Netherlands)). 2 Oct 1987. 64p. (In Dutch). (NLR-TR—87132-U). NTIS, PC E04/MF A01.

For the development of methods for aerospace research and development at NLR large computer facilities are available, among which a NEC SX-2 supercomputer, a Control Data Cyber 180-855 mainframe and various minicomputers and work station. To provide users a good access to the various systems a high-speed computer network is defined, existing of a communication network for terminal data transfer and one for file transfer in lock.

4049 **(PB—88-242144/XAB) Programming languages for distributed systems.** Bal, H.E.; Steiner, J.G.; Tanenbaum, A.S. (Vrije Univ., Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica). Feb 1988. 84p. (IR—147). NTIS, PC E04/MF A01.

This paper presents a survey of recent research in programming distributed systems, with the emphasis on new programming languages specifically designed for this purpose. Short descriptions are given of 20 languages. In addition, a comprehensive bibliography provides over 250 references to more than 100 languages for distributed programming.

4050 **(PB—88-242276/XAB) Report on a comparative study of four vector processors for matrix:vector operations.** Thomsen, P.G. (Trondheim Univ. (Norway). Computing Centre). 13 May 1988. 16p. NTIS, PC E03/MF E03.

Also pub. as Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway) rept. no. STF13-A88004.

This study was initiated in order to obtain some conclusive comparisons for a group of vector processors, from studying their performance results on a set of problems designed to be representative of the processes that are involved when solving large systems of linear equations using iterative or sparse matrix methods. The set of vector processors that tested were chosen from their availability for the people involved in this test. They are Cray-X/MP 2 with one or two processors in action, IBM-3090 with two versions of the Fortran compiler, Amdahl VP-1100, and Convex XP-1 (C-120). The machines have very different performance characteristics and in some cases the results depend on the accuracy as well.

4051 **(REPT—88-005) Using Petri nets for real-time development environments.** Morasca, S.; Pezze, M. (Politecnico di Milano (Italy)). 1988. 20p. (ETN—88-92787). Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy.

The development of concurrent real-time systems is considered. An integrated environment for their development, based on a formal and intuitive core model, is needed to carry out correctness proofs and to provide user friendly interfaces. Petri nets are well suited, even if not powerful enough. A formalism, time generalized nets able to integrate most proposed extensions and to provide a rigorous semantics of time within the model, is presented. A set of tools, based on this model, composing an integrated environment for the development of concurrent real-time systems is outlined.

4052 **(RFP—4185) Survey of developments in measurement error analysis.** Bell, B.E.; Thomas, R.L. (ed.). (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 14 Sep 1988. Contract AC04-76DP03533. 14p. NTIS, PC A03/MF A01. Order Number DE89002542/JAW.

A survey has been prepared on recent developments in the field of measurement error analysis. Three topics are covered. Industrial Standardization of Error Analysis: A methodology has been established for uniform measurement uncertainty analysis. Improving Parameter Estimates: A technique has been devised utilizing the uncertainty interval overlap of parameter estimates, along with weighted average uncertainty intervals, to reduce overall parameter estimate errors. The possibility of using these uncertainty interval overlaps as a type of data validity test is also explored. Although not rigorously defensible at this time, work continues in this area. Combining Statistical, Interval, and Fuzzy Methods: Errors introduced by strict statistical methods in error analysis, especially in the determination of physical constants, are examined. Included in this examination are ways to utilize interval methods. These permit set operations when analyzing data for well-defined uncertainty limits, providing the possibility of more realistic results. The case is examined when uncertainty limits are not well defined, i.e., the uncertainty of the uncertainty limit is significant. A technique utilizing fuzzy methods is employed for this case. The survey finishes with a look at areas requiring further research. 9 refs., 4 figs.

4053 **(SAND—88-1977) TOOHIST: A history post-processor for ARTOO.** Swegle, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 79p. NTIS, PC A04/MF A01. Order Number DE89002826/JAW.

TOOHIST is the history plotting program for ARTOO, the automatically rezoning version of the two-dimensional Lagrangian wavecode TOODY. The code reads and plots from ARTOO history dump files, using the RSCORS plot package. TOOHIST was designed for ease of use, while maintaining complete user control over the plots the user may wish to produce. Free format input commands consist of descriptive English language phrases, which result in readable input files, and aids in memorizing command forms. Cross-plotting, color, external data plotting, and legend drawing options are included. Extensive error checking is done and explanatory messages are issued when errors are detected. 3 refs., 11 figs.

4054 **(SAND—88-8971) A visualization model based on the mathematics of fiber bundles.** Butler, D.M.; Pendley, M.H. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DR00789. 22p. NTIS, PC A03/MF A01. Order Number DE89002537/JAW.

In this report, we describe a visualization model based on the mathematics of fiber bundles. In a companion report [SAND 88-8972], we introduced the visualization management system (ViMS), a new approach to the development of software for visualization in scientific computing (ViSC). A visualization management system implements a visualization model which specifies the class of geometric objects, the graphic representations of the objects and the operations provided by the system. In the model described here, the geometric objects are sections of fiber bundles. We give a brief, intuitive description of the mathematics of fiber bundles, emphasizing aspects relevant to our visualization model. We describe three important classes of operations on fiber bundles. We develop a flexible scheme for constructing graphic representations of fiber bundles and a simple but useful visualization taxonomy. 7 refs., 5 figs., 1 tab.

4055 **(SAND—88-8972) The visualization management system approach to visualization in scientific computing.** Butler, D.M.; Pendley, M.H. (Sandia National Labs., Albuquerque, NM (USA); Limit Point Systems, Fremont, CA (USA)). Sep 1988. Contract AC04-76DP00789. 15p. NTIS, PC A03/MF A01. Order Number DE89002538/JAW.

In this report, we introduce the visualization management system (ViMS), a new approach to the development of software for visualization in scientific computing (ViSC). The conceptual foundation for a ViMS is an abstract visualization model which specifies a class of geometric objects, the graphic representations of the objects and the operations on both. A ViMS implements a visualization model and provides four levels of mechanisms for developing applications. We describe ViMS requirements and a model- independent ViMS architecture. The ViMS approach presents several important opportunities for visualization standards. 5 refs., 1 fig.

4056 **(SAND—88-9003) Controller{endash}Programmer for telemetry systems.** Daniels, R.M. (Sandia National Labs., Livermore, CA (USA)). Oct 1988. Contract AC04-76DP00789. 56p. NTIS, PC A03/MF A01. Order Number DE89002539/JAW.

The development, testing, and implementation of modern, sophisticated telemetry systems requires a controller capable of adequately exercising the telemeter. A flight test requires a programmer to cycle through the flight events. This report describes an adaptable, programmable system that encompasses both of these requirements. 30 refs., 18 figs., 4 tabs.

4057 **(SLAC-PUB—4777) Monolithic transceiver for FASTBUS Cable Segment: CSX.** Walz, H.V.; Bertolucci, B.; Gustavson, D.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 4p. (CONF-881103—8). NTIS, PC A02/MF A01. Order Number DE89002833/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

Specifications for a five-channel differential transceiver for the FASTBUS Cable Segment have been developed. The transceiver, CSX, is being planned as a full-custom integrated circuit implementation. Specification and development plans are discussed. The project is being carried out in collaboration with the NIM/FASTBUS Committee. 2 refs., 3 figs.

4058 (UCRL—53868-87, pp 6.25-6.29) **Precision CNC controller.** Sweeney, D.J.; Weinert, G.F. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have built a generic high-precision computer numerical controller (CNC) for use on any of the many microinch- and submicroinch-resolution machine tools in use in the Materials Fabrication Division of Mechanical Engineering, e.g., Precision Engineering Research Lathe (PERL), PERL II, and CBN. To fully utilize the potential of these machine tools, the CNC must be able to use multiple feedback sensors on each machine axis, incorporate corrections for quasi-static geometric errors (such as straightness and squareness), function over a relatively large range of motion (in excess of 60 in./axis), and produce motion updates fast enough to take advantage of the high bandwidth of the servo systems. At present, no commercially available CNC can meet all the resolution, feedrate, and length-of-travel requirements of these machines. To minimize system complexity and thus increase reliability and maintainability, the authors programmed computers in C, minimized the number of processors, and bought commercially available hardware whenever possible. In addition, they tried to make the CNC's operator interface as friendly as possible.

4059 (UCRL—53868-87, pp 9.24-9.25) **High-resolution and three-dimensional imaging.** Wieting, M.G.; Miller, V.J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors have developed a general-purpose image-processing program called VIEW that takes advantage of workstations, high-resolution color monitors, hardware accelerators, and windowing systems. VIEW is a research and production tool that can quickly process large amounts of data of any type and size. Operable on both Vax mainframes and Sun workstations, VIEW boasts a window-based user interface and can display color images in one, two, or three dimensions.

4060 (UCRL—53868-87, pp 10.19-10.22) **Hardware designs for real-time digital signal processing.** Current, K.W.; Jain, A.K. (Univ. of California, Davis (USA)). Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

By using new, high-performance digital signal processing (DSP) integrated-circuit (IC) chips, the authors can design hardware to process, in real time, sophisticated algorithms that once had to be processed in software. They have conducted three related projects. First, they programmed three adaptive noise-canceling algorithms to run on Texas Instruments TMS 32020 DSP chips; the algorithms' performance was tested and the results compared. Although the stochastic gradient transversal algorithm was found to be potentially most useful when implemented with the fixed-point arithmetic chip, new floating-point-arithmetic DSP chips may allow other algorithms to excel. The second project involved designing an IC for processing a discrete cosine transform/inverse discrete cosine transform algorithm. Such algorithms are useful in 10-MHz video data compression. Finally, they designed a complementary metal-oxide semiconductor test chip to demonstrate the relatively easy, inexpensive, and quick fabrication turnaround times possible with inexpensive workstations, public domain layout software, and contract fabrication facilities.

4061 (UCRL—53868-87, pp 10.29-10.30) **Smoothness priors in time series.** Gersch, W. (Univ. of Hawaii, Honolulu (USA)). Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The goal is to provide algorithms for the analysis of time series by using a new technical development, the Bayesian smoothness priors analysis of time series. He describes six programs that have been delivered to LLNL and that are to be installed on a Sun computer workstation.

4062 (UCRL—53868-87, pp 10.31-10.33) **Lattice modeling algorithms.** Hernandez, J.E. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The goal was to expand the lattice-based modeling capabilities within SIG, a general-purpose signal processing program. New algorithms implemented include layer peeling, spectral estimation, and adaptive lattice modeling. The author also worked on the reconstruction of clipped data. All algorithms developed should be available in the next release of SIG.

4063 (UCRL—53868-87, pp 10.34-10.35) **Image-processing research facility development.** Portnoff, M.R.; Sherwood, R.J. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The Image-Processing Research Facility (IPRF) is an Electronics Engineering facility available to LLNL programs and personnel for developing and running image-processing algorithms. The facility has a growing library of general-purpose image-processing algorithms; it is organized in such a way that the algorithms can be applied to a variety of image data. This year the authors have improved the video digitizer system to give users more software control over image-processing functions in the video digitizer, written software so they can copy images displayed on the IPRF image processor to a magnetic tape in a format that allows the image to be displayed in the Applied Computational Engineering laboratory, and provided image-processing software for users in the Nuclear Energy Systems Division and the Field Test Systems Division. In addition, they have actively participated in the Multi-Dimensional Signal- and Image-Processing Working Group, whose purpose is to reduce redundant efforts and improve communication among various groups doing image processing at the Laboratory.

4064 (UCRL—53868-87, pp 10.36-10.39) **Parametric and nonparametric system identification and deconvolution.** Goodman, D.M. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The author has written computer codes that use both parametric and nonparametric methods for processing signals in the time domain. Time-domain methods for impulse-response identification and deconvolution problems are more flexible than their frequency-domain counterparts. With the advent of faster computers, time-domain approaches have become the methods of choice for solving these problems.

4065 (UCRL—53868-87, pp 10.40-10.42) **AI workstation environment.** Searfus, R.M.; Lager, D.L. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The authors are developing a portable LISP programming environment for conventional workstations. The environment, similar to those of LISP-based computers such as the Symbolics 3600 or Texas Instruments Explorer, is written in Common LISP and C and is based on the X Window system and the GNU Emacs editor.

4066 (UCRL—53868-87, pp 10.43-10.45) **Performance validation given inherently limited test data.** Sicherman, A. Apr 1988. NTIS, PC A14/MF A01. Order Number DE88013792/JAW.

In Engineering research and development: Thrust area report, FY 87.

The author is developing an analytic framework to help decision makers design testing programs for validating system performance when traditional statistical methods are not applicable. Such situations occur when costs or operational disruptions constrain the scope and number of tests, when a system is modified in response to test results, or when a system degrades with time. In FY 87 he identified promising techniques and illustrated their applicability and practicality. These techniques give decision makers a way to minimize the number of tests required to validate (i.e., accept or reject) a system under test. In FY 88 he will write software to implement these techniques.

4067 **(UCRL—99356) Workstation fiber panel.** Rupert, P.R. (Lawrence Livermore National Lab., CA (USA)). 3 Aug 1988. Contract W-7405-ENG-48. 4p. (CONF-8808148—1). NTIS, PC A02. Order Number DE89001502/JAW.

From 13. conference on local computer networks; Minneapolis, MN, USA (5 Aug 1988).

This note discusses the decision process used by LLNL to install fibers from the office to the local wiring closet.

4068 **(UCRL—99708) Sisal implementation and performance.** Skedzielewski, S. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 4p. (CONF-8808155—1). NTIS, PC A02/MF A01. Order Number DE89001901/JAW.

From International Federation of Information Processing (IFIP) working group 2.5; Stanford, CA, USA (25 Aug 1988).

This paper discusses the effect of several code-improvement techniques on programs written in the SISAL language. SISAL is an applicative language, and the debate about the efficient implementation of such languages has continued for several years. We discuss several sources of inefficiency in the current SISAL compilation and runtime system, and extrapolate the effect of new code improvements and code generators from small examples that we are running in the next generation of SISAL compilers. 8 refs.

4069 **(UCRL—99762) Coarse grid acceleration of some domain decomposition methods on multiprocessors.** Rodrigue, G.; Ferretta, T. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 11p. (CONF-8808155—2). NTIS, PC A03/MF A01. Order Number DE89002871/JAW.

From International Federation of Information Processing (IFIP) working group 2.5; Stanford, CA, USA (25 Aug 1988).

This paper discusses numerical methods for solving partial differential equations. The topics discussed in this report are: Domain decomposition, Schwarz methods, numerical Schwarz methods, and coarse grid acceleration. 7 refs., 2 tabs. (LSP)

4070 **(UTIIS—8801) Research on automatic extraction of map information and its image representation.** Yanagida, Satoshi; Murai, Shunji. (Tokyo Univ. (Japan). Inst. of Industrial Science). 29 Feb 1988. 46p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754960/JAW.

Various softwares were developed to input or storage map information in computers and to output printing films efficientlly. The automatic input system allowing to input closed area graphic data with attribute information by the input of boundary charts with color symbols or painted charts using a drum scanner was developed, And also the system extracting and vectorizing building profile lined from inputed city planning maps was developed. As for storage, the improved run length format achieving easily an efficient data compression ratio, rapid retrieval, data registration or data transfer to a raster type output device was developed. The output system generating digital dot patterns to output printing films by a laser printer was developed, thereby eliminating a vast amount of manual operation, These systems are capable of practical uses without any enhancements. (77 figs, 3 tabs, 18 refs)

9903 Information Handling

REFER ALSO TO CITATION(S) 3302, 4049

4071 **(AD-A—195854/5/XAB) Integrating images, applications, and communications networks. Volume 5. Final report, September 1986-January 1988.** Gupta, A.; Madnick, S. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1987. 342p. (MIT-KBIISE—5). NTIS, PC A15/MF A01.

See also Volume 6, AD-A195 855.

This volume presents practical ideas and prototype systems for integrating existing information and communications resources. It is divided into four parts. The first part, 'Knowledge-Based Pictorial Information Systems,' describes a prototype system that enables users to manage all types of information, especially pictorial information. The Image Database Management System (IDBM) provides an integrated standard that can be used to specify the information to be retrieved, in a format acceptable to all participating computers. The second part, 'Storage and Retrieval of Pictorial Information in Heterogeneous Computing Systems,' studies existing techniques for storing pictorial images, such as bit-mapped mechanisms, vector-based techniques, and quadtree and pyramid-oriented approaches. Recent advances in compression techniques are also discussed. The third part, 'An Expert System for Accessing and Integrating Design Analysis Knowledge,' presents an approach for integrating information from multiple design environments. Mechanical design packages such as CADAM and CATIA, thermal design packages such as ITAM and PHOENIS, and other specialized packages can be linked together through a common expert system. The fourth part highlights a number of critical connectivity issues in the context of data communication networks maintained by two large organizations. (RH)

4072 **(SAND—88-2742C) NC engineering logbook.** Plomp, P.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-8810211—2). NTIS, PC A03/MF A01. Order Number DE89001487/JAW.

From IMOG - numerical systems group meeting; Livermore, CA, USA (18 Oct 1988).

The NC Engineering Logbook project encompasses data entry techniques, information organized methods, and reporting capabilities. The logbook is used to organize and gather information regarding all NC part programs which are developed by the NC engineering and craftworker staffs in the Sandia Mechanical Processing Department. Data input and information queries have been organized using interactive techniques. The data are stored in a relational database for easy access. Standard queries and reports are available to provide information for users and managers to plan new equipment acquisitions, estimate manpower requirements for similar work, and determine trends. 2 tabs.

4073 **(UCID—21495) Fabrication Control System functional requirements specification for FCS/1.** Owens, C.; Nazario, O.; Parrish, C.; Steinhauff, E.; Whitney, D. (Lawrence Livermore National Lab., CA (USA)). 26 May 1987. Contract W-7405-ENG-48. 391p. NTIS, PC A17. Order Number DE89002652/JAW.

The purpose of the Fabrication Control System phase one (FCS/1) Functional Requirements Specification document is to present the complete and detailed set of the Material Fabrication Division (MFD) requirements for FCS/1 to MFD for review and approval. It serves as a tool for measuring and controlling the progress of the design and implementation of the FCS/1 software. This FCS/1 Functional Requirements Specification documents is organized into three sections, plus appendices. They are: Section 1 Introduction, Section 2 General Description, and Section 3 Specific Requirements. Section 2 contains a high level view of the functional requirements. This description includes the upper level data flow diagrams (i.e., the Context and Level 1 Data Flow Diagrams). Section 3 contains all of the detailed specifications that the software team needs to create the design for FCS/1.

4074 **(UCRL—99272) The product definition initiative in the Department of Energy Nuclear Weapons Complex.** Wapman, P.D. (Lawrence Livermore National Lab., CA (USA)). 17 Aug 1988. Contract W-7405-ENG-48. 10p. (CONF-8810208—1). NTIS, PC A03/MF A01. Order Number DE89001495/JAW.

From 5. Chautaugua on productivity in engineering and design; Newport, RI, USA (9 Oct 1988).

The US Department of Energy Nuclear Weapons Complex (NWC) formed the Product Definition initiative (PDI) to identify, using information modeling techniques, the NWC product data to be implemented in a computer environment. Information modeling techniques are used to assemble the product data required by a specific problem domain into a logical form. The resulting model may be used to generate a complete, accurate, and unambiguous database for the electronic exchange and utilization of product data. This reduces the need for human interpretation of product definition data and can serve as the foundation for the automation of many manufacturing applications. The PDI project is developing application or resource information models for five domains of interest to the NWC: Drafting, Numerical Control, Inspection, Tooling, and Form Features. Additionally, the project is working closely with vendors, other NWC computer integrated manufacturing initiatives, and the National Bureau of Standards Product Data Exchange Specification (PDES) project to ensure the NWC's product data needs will be met by future exchange protocols and CADD/CAM systems. 1 ref., 1 fig.

9904 Law

4075 **(SAAS—363) Regulatory practice for safety of nuclear energy in the German Democratic Republic. Questions and answers.** Krueger, F.W.; Arndt, H.; Nessau, L.; Rabold, H.; Roehnsch, W.; Scheel, H. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. 29p. NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE88704938/JAW.

An outline of the regulatory practice applied in the GDR to ensure the safe use of nuclear energy is given in the form of answers to a questionnaire issued by the IAEA with the objective of giving the international community confidence in the safety of nuclear power programmes.

9905 Civilian Defense

REFER ALSO TO CITATION(S) 3372, 4031

4076 **(AD-A—196739/7/XAB) Civic improvement program. Volume 2. Fallout protection-factor analysis capability. Technical report, 15 September 1985-15 August 1987.** Stoddard, J.A. (Science Applications International Corp., San Diego, CA (USA)). 15 Aug 1987. 70p. (SAIC—87/1746). NTIS, PC A04/MF A01.

The Vehicle Code System (VCS), originally developed to calculate initial radiation environments and protection factors for three-dimensional shield systems, was modified to calculate protection factors for fallout radiation environments. This report describes the modifications to VCS and gives the results of several test-case analyses performed to verify this fallout protection-factor version. Fallout radiation-protection-factor calculations were performed for a number of structures for which simulated fallout experiments had been performed in the late 1950's and early 1960's. The comparisons were generally good, with about half of the results agreeing within 10% and three-quarters of the results agreeing within 20%. Disagreement was found in some cases where descriptions of the structure were not adequate. Based on these overall results, the authors feels the fallout protection-factor version of VCS is performing correctly. Calculations were also performed to assess the potential effect on fallout-protection factors of a number of variations in typical structures. Variations explored included the effects of internal partitions, attached garages, basement depth, structure length-to-width ratio, and fallout-contaminated balconies.

4077 **(AD-A—197037/5/XAB) Interceptor-to-target allocation strategies for Strategic Defense I: adaptive strategies based upon system and threat characteristics. Final report, January-September 1987.** Smith, M.E.; Paterson, T.S. (Institute for Defense Analyses, Alexandria, VA (USA)). Jul 1988. 37p. (IDA-P—2058). NTIS, PC A03/MF A01.

This paper examines the topic of interceptor-to-target assignment algorithms and compares the system performance of a strategic defense system (SDS) as a function of the algorithm used. The algorithms used in this study range from being similar to some of those being developed under the SDIO's advanced-algorithm programs to those used in some of the more-popular engagement models. It is shown that the use of less-sophisticated algorithms can often lead to RV leakages twice as large compared to cases in which sophisticated algorithms are used. The primary conclusion from this paper is that as the defense becomes interceptor-rich and/or the Pk of the interceptor becomes low, the popular one-interceptor-per-target approaches to interceptor allocation, which are typically found in the community-wide engagement models, can perform poorly. When the defense is in either, or both, of these regimes, it can perform significantly better by adopting an approach in which the salvo becomes a credible strategy. Because the salvo strategies have not been implemented in the popular engagement models, the past analyses which have studied these types of architectures have been biased toward providing a lower level of performance. Interceptor allocation strategies for the midcourse and terminal phase are not analyzed in this paper.

4078 **(CONF-8810197—1) The ATO [Air Tasking Order]: Improving JTLS' [Joint Theater Level Simulation] C³I with an expert system.** Hartley, D.; Allgood, G. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01. Order Number DE89001203/JAW.

From Washington Operations Research Management Science Council (WORMSC) conference; Washington, DC, USA (5 Oct 1988).

The Air Tasking Order (ATO) Advisor models the human cognitive functions (Command, Control, Communications, and Intelligence [C³I]) required for interaction with the Joint Theater Level Simulation (JTLS) at the theater level (rather than the air mission level). The ATO Advisor applies specifically to the air war portion of the simulation. It contains an expert system, a decision support system, and a group of fast running LISP and C service routines. Beyond the needs of JTLS, the ATO Advisor provides a paradigm for future C³I modeling. 5 figs.

4079 **(UCRL—99768) The space-based interceptor.** Cunningham, C.T. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 30p. (CONF-8804202—2). NTIS, PC A03/MF A01. Order Number DE89002869/JAW.

From Nuclear arms technologies in the 1990's; Washington, DC, USA (16 Apr 1988).

We calculate the effectiveness and marginal cost-effectiveness of SBI defenses against a variety of possible Soviet threats. Defense effectiveness is expressed in terms of participation fraction, which depends on SBI flyout distance and threat basing, and in terms of the number of interceptors needed to accomplish a given mission. Optimal interceptor sizing favors large high velocity rockets. With such optimal design, the defense appears marginally cost-effective with a 50% kill criterion against current or responsively modified large liquid boosters, although not against more stressing threats. Survivability of direct attack is not assessed, although survivability enhancement options are briefly discussed. 8 refs., 10 figs., 6 tabs.